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UNITED STATES POSTAL RATE COMMISSION

In the Matter of: POSTAL RATE AND FEE CHANGE

Docket No. R2000-1

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BEFORE THE
POSTAL RATE COMMISSION

- - - - - - - - - - - - - - - - - - - -X
In the Matter of: :
POSTAL RATE AND FEE CHANGE : Docket No. R2000-1
- - - - - - - - - - - - - - - - - - - -X

Third Floor Hearing Room
Postal Rate Commission
1333 H Street, N.W.
Washington, D.C 20268

Volume XXVII
Thursday, July 13, 2000

The above-entitled matter came on for hearing, pursuant to notice, at 9:39 a.m.

BEFORE:
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HON. GEORGE A. OMAS, VICE CHAIRMAN
HON. W.H. "TREY" LeBLANC, COMMISSIONER
HON. DANA B. "DANNY" COVINGTON, COMMISSIONER
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C O N T E N T S

E X H I B I T S

EXHIBITS AND/OR TESTIMONY	IDENTIFIED	RECEIVED
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PROCEEDINGS

[9:39 a.m.]

CHAIRMAN GLEIMAN: Good morning. Today we continue our hearings to receive the direct cases of participants other than the Postal Service in Docket R2000-1.

Does any participant have a matter that they would like to raise before we begin today?

If not, I will note that there are four witnesses scheduled to appear today, Witnesses Neels, Sellick, Hay, and Smith.

As I mentioned at yesterday's hearing, counsel for the Magazine Publishers of America and the Postal Service arranged to forego oral cross examination of Witness Hay, and it is my understanding that additional designated written cross examination for this witness will be designated at a future date in order to fulfill what arrangements have been made.

That being the case, we would ordinarily proceed to incorporate Witness Hay's testimony right now, but I don't believe the attorney who is handling that witness is here right now, so we will move on to our next scheduled witness.

Mr. McKeever, would you please introduce your witness?

MR. McKEEVER: Thank you, Mr. Chairman. United Parcel Service calls Dr. Kevin Neels to the stand.

CHAIRMAN GLEIMAN: Mr. Neels, before you settle in, if I could get you to raise your right hand.

Whereupon,

KEVIN NEELS,

a witness, was called for examination by counsel for the United Parcel Service and, having been first duly sworn, was examined and testified as follows:

CHAIRMAN GLEIMAN: Please be seated.

DIRECT EXAMINATION

BY MR. McKEEVER:

Q Dr. Neels, I have just handed you a copy of a document entitled "Direct Testimony of Kevin Neels on Behalf of United Parcel Service on Mail Processing Costs" and marked as UPS-T-1.

If you were to testify orally today here, Dr. Neels, would your testimony be as set forth in that document?

A It would.

MR. McKEEVER: Mr. Chairman, I move that the direct testimony of Kevin Neels on behalf of United Parcel Service on mail processing costs and identified as UPS-T-1 be admitted into evidence and transcribed into the transcript of today's proceedings.

CHAIRMAN GLEIMAN: Is there an objection?

Hearing none, counsel, if you would please provide two copies of Witness Neels' testimony to the court reporter, I will direct that that material be transcribed into the record and received into evidence.

[Direct Testimony of Kevin Neels, UPS-T-1, was received into evidence and transcribed into the record.]

UPS-T-1

BEFORE THE
POSTAL RATE COMMISSION

POSTAL RATE AND FEE CHANGES, 2000	:	DOCKET NO. R2000-1

DIRECT TESTIMONY
OF
KEVIN NEELS
ON BEHALF OF
UNITED PARCEL SERVICE
ON MAIL PROCESSING COSTS

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BIOGRAPHY

My name is Kevin Neels. I am a vice president at the economic consulting firm of Charles River Associates, where I direct that firm's transportation practice. I have directed and participated in numerous research projects and consulting engagements dealing with a variety of issues in transportation economics. The aviation sector has been a particular focus of my work, and I have played key roles in a variety of projects dealing with air cargo market structure, airline pricing strategy, airline industry competitive structure, airport operations and finance, and passenger travel behavior. I have also addressed topics relating to pipelines, automobile manufacturing and distribution, and urban transportation.

On a number of occasions I have been asked to offer expert testimony in legal and regulatory proceedings. In many instances, my testimony has involved calculation of the proper measure of damages. These calculations have required extensive empirical investigations of business sales, revenues, and costs, with a particular emphasis on establishing the extent to which costs vary with changes in sales and production volumes. Often my work has involved the application of econometric analysis techniques. I have played a major role in estimating damages arising from antitrust violations, patent infringement, misappropriation of trade secrets, price-fixing, and contract violations. My testimony has addressed a number of different industries, including pharmaceuticals, medical devices, commercial aviation, durable consumer products, crude oil production and refining, and automobile manufacturing and sales.

In Docket No. R97-1, I offered testimony on behalf of United Parcel Service on the Postal Service's econometric study of the volume variability of mail-processing costs. I am also submitting testimony on that subject in this proceeding.

My curriculum vitae is attached as Appendix A.

PURPOSE OF MY TESTIMONY

I have been asked to comment on the study of mail processing labor hour variability introduced by Witness Bozzo in this case on behalf of the United States Postal Service. Because Dr. Bozzo's study is supported by and relies upon the testimony of Postal Service Witness Degen, I also review and analyze Mr. Degen's statements regarding the variability of mail processing labor hours.

In the first section of my testimony, I review the choices that the Postal Service faces as it attempts to deal with increases in mail volume, and I analyze the implications of those choices for the study of mail processing labor cost variability. This discussion provides background for my critique, which follows in the second section of my testimony, of the mail processing cost study presented by Dr. Bozzo.

After reviewing Dr. Bozzo's analysis, I review the operational and theoretical evidence for the presence or absence of economies of scale in mail processing. This section focuses on the testimony of Mr. Degen and on his argument that there are economies of scale in mail processing. I carefully analyze Mr. Degen's arguments, and I point out some serious flaws in them.

I then present alternative calculations of the volume variability of mail processing labor costs that correct for some of the flaws in Dr. Bozzo's study. I find that correcting

these flaws leads to estimates of mail processing cost variability that equal or exceed 100 percent.

The final section of my testimony presents recommendations about how mail processing labor costs should be treated in this proceeding. I also offer some suggestions about what an empirically and conceptually sound analysis of mail processing labor cost variability should look like.

HOW DOES THE POSTAL SERVICE RESPOND TO CHANGES IN VOLUME?

As Dr. Bozzo has noted, there was considerable controversy in Docket No. R97-1 about the length of time over which the response of mail processing labor costs to changes in volume should be measured. In that proceeding, I criticized Professor Bradley's study for taking an excessively short run view of the response of costs to changes in volume. Other witnesses agreed with this criticism.[1]

In response, Dr. Bozzo has modified Dr. Bradley's econometric specifications to permit adjustments to changes in volume to take place over a longer period of time. Although I believe this change is necessary, I am still troubled by the extremely narrow, short run view taken in the new analysis of how the Postal Service accommodates changes in mail volume.

Dr. Bozzo has noted that in R97-1, all parties accepted the proposition that the economic concept of the "long run" involved a period of time sufficient to allow a firm to adjust fully to changes in volume and factor prices.[2] Thus, the distinction between short

1. See, e.g., the testimony of OCA Witness Smith in Docket No. R97-1, Tr. 28/15835-36.

2. USPS-T-15, p. 17.

run and long run responses to changes in volume has to do essentially with the completeness of the Postal Service's response to a change in mail volume. Obviously, the more time one allows, the more complete that response will be.

Although this distinction between the short run and the long run has to do with the period of time over which a response takes place, one can also analyze this question in functional terms. A change in volume can affect many different aspects of postal operations and trigger decisions in many different areas. The difference between a short run response to an increase in volume and a long run response has to do with which aspects of postal operations are held constant, and which are allowed to vary.

In order to place Dr. Bozzo's results in perspective, it is helpful to review the various ways in which the Postal Service actually responds to increases in the volume of mail to be processed. The record in this proceeding provides considerable evidence regarding the nature of that response and of the economic decisions and tradeoffs that it entails.

(1) Staffing Level Changes

Dr. Bozzo's study focuses on the response of staffing levels to changes in volume. As he notes, decisions regarding mail processing staffing levels occur over two distinct time frames.[3] The first is measured in hours, and involves redeployment of the existing staff among the different mail processing activities present in the plant. In this context, plant supervisors respond to stochastic, or unpredictable and random, variations in the volume and mix of mail to be sorted. To some extent, adjustments can

3. USPS-T-15 at 18.

be made to accommodate growth in volume, although over a very short time frame the available options may be limited.[4]

The second adjustment described by Dr. Bozzo involves changing the size or composition of the staff. There are substantial transaction costs associated either with the hiring of new staff, or with the downsizing, transfer, or redeployment of existing staff. For this reason, these latter decisions, Dr. Bozzo says, can take up to a year to implement.[5]

(2) Automation and Mechanization

Another broad area of decisionmaking that is heavily affected by growth in mail processing volume involves capital expenditures on mail processing equipment. As Postal Service Witness Kingsley makes clear, decisions regarding the installation or upgrading of mail processing equipment are often driven by the need to accommodate growth in volume.[6] Actions taken to increase mail processing capacity can take a number of different forms. For example, existing equipment can be upgraded to enhance its capacity; new machines can be installed; and different types of MODS activities can be added to mail processing plants. As the record in this proceeding amply indicates, all of these changes have taken place since the filing of the last general postal rate case.

4. To accommodate a sudden increase in volume a supervisor can ask workers to defer time off, authorize extra overtime, monitor workers more closely to minimize unproductive downtime, or alter work practices in an effort to increase productivity.
5. USPS-T-15, p. 18.
6. See, e.g., USPS-T-10, pp. 12-15, 31-32.

The testimony of Ms. Kingsley describes numerous instances in which existing equipment has been upgraded. Just a few quotations are sufficient to provide a good sense of the nature of the Postal Service's activities in this area:

- "This past year all of the FSM 881s were retrofitted with OCRs that can read the addresses on flats."[7]
- "A total of 875 MLOCRs are deployed. No additional deployments are planned, but several enhancements since Docket R97-1 have been added, including a Grayscale Camera, a co-directory lookup, and a co-processor. The Grayscale Camera facilitates better image capture (256 shades of gray instead of just black and white) while the co-directory and co-processor augment the address matching process through redundancy. These enhancements have improved the overall encode rate of the MLOCR and reduced the amount of mail that obtains a barcode through Remote Bar Coding."[8]
- "The addition of the Mail Cartridge System (MCS) to the DBCSs is currently planned to commence near the end of FY 2001 into FY2002. The MCS will eliminate sweeping and second pass ledge loading for DPS processing."[9]
- "The SBPS Feed System has been a recent addition to the SPBS. These feed systems consolidate all the induction lines into a centralized network capable of transferring mail from all types of mail containers and transporting the contents on mechanized conveyors to the induction/keying consoles."[10]

Augmentation of an existing mail processing operation through the installation of additional equipment or the upgrade of existing machinery is also a frequent occurrence. Table 1 shows the average number of machines per site for a number of

7. USPS-T-10, p. 10.
8. USPS-T-10, p. 4.
9. USPS-T-10, p. 9.
10. USPS-T-10, p. 20.

important mechanized MODS activities for the period from 1993 through 1998. It shows substantial increases in a number of different areas.

Table 1

Multi-Machine Installations and Changes in Sorting Technology Over Time
Average Number of Machines per Site

MODS Group	Equipment Description	PCN	1993	1994	1995	1996	1997	1998
Metered Cancellations	Culling Machine	400000	1.436	1.381	1.398	1.418	1.487	1.454
Metered Cancellations	Cancelling/Facing Machine	401020	5.588	5.945	4.487	4.529	4.581	5.976
LSM	Letter Sorting Machine, Multi Pos	910000	7.012	7.727	7.698	7.484	5.284	3.603
FSM	Flat Sorter Machine	920000	5.631	8.614	9.546	9.621	9.693	11.329
SPBS	Parcel Sorting Machine	930000	3.714	2.640	1.463	1.576	1.638	1.932
SPBS	Small Parcel/Bundle Sorter System	930040	4.016	4.081	3.922	4.078	5.000	5.576
BCS	Bar Code Reader	950000	15.780	19.339	18.490	17.847	9.716	9.648
BCS	Small Bar Code Sorter (SBCS)	950010	7.323	7.411	7.400	7.885	9.878	17.029
BCS	Delivery Bar Code Sorters (DBCS)	950020	6.743	14.964	20.015	24.773	25.261	26.621
OCR	Reader, Optical Character	960000	2.950	3.440	3.574	3.352	4.000	4.638
OCR	Reader, Optical Character (OCR/CS)	960010	5.715	6.462	7.031	8.048	9.797	18.613

Notes and Sources:

1. Data from MPE93.txt - MPE98.txt, provided in USPS-LR-I-244.
2. Site-specific equipment counts are average over sites that have some equipment.
3. Appendix B presents average number of machines per site for all PCN codes.

Yet another way in which the Postal Service accommodates increases in mail volume is by establishing automated or mechanized processing activities in plants where these activities had previously not been present. These actions are manifested in changes in the mix of MODS activities present at a site. According to Dr. Bozzo's data, activity mix at a plant is highly dynamic. Table 2 summarizes changes over time in the mix of activities present in the processing plants in Dr. Bozzo's sample. An activity is regarded as "present" during a time period if positive values are reported for pieces handled.

Table 2

Changes Over Time in the
Percent of Sites Reporting Each Activity Mix in the Fourth Quarter of Each Year

Letter Sorting

Activity Present?				1993	1994	1995	1996	1997	1998
OCR	LSM	BCS	Manual Letters						
yes	yes	yes	yes	85.98	87.23	87.23	81.31	39.25	9.35
yes	yes	yes	no					0.31	
yes	yes	no	yes	0.93					
yes	no	yes	yes	4.05	4.98	6.54	12.15	53.58	75.39
yes	no	yes	no						0.62
yes	no	no	yes	0.62	0.62	0.31	0.31		
no	yes	yes	yes	1.25	1.56	1.56	1.25	0.93	3.43
no	yes	no	yes	0.93	0.93	0.31			
no	no	yes	yes	2.49	1.87	2.18	2.80	3.74	8.72
no	no	yes	no				0.31	0.31	0.31
no	no	no	yes	0.93	0.62	0.62	0.62	0.62	0.62
no	no	no	no	2.80	2.18	1.25	1.25	1.25	1.56

Flat Sorting

Activity Present?		1993	1994	1995	1996	1997	1998
FSM	Manual Flats						
yes	yes	75.08	75.70	75.70	74.77	74.77	76.95
yes	no				0.31	0.62	1.56
no	yes	22.12	22.12	23.05	23.68	23.05	19.94
no	no	2.80	2.18	1.25	1.25	1.56	1.56

Parcel Sorting

Activity Present?		1993	1994	1995	1996	1997	1998
SPBS	Manual Parcels						
yes	yes	17.76	23.36	24.30	23.68	32.09	26.48
yes	no	4.05	6.85	7.48	11.21	9.03	13.08
no	yes	68.22	62.31	62.93	60.12	52.96	54.83
no	no	9.97	7.48	5.30	4.98	5.92	5.61

Priority Mail Sorting

Activity Present?	1993	1994	1995	1996	1997	1998
yes	75.39	78.50	80.37	80.06	81.31	75.08
no	24.61	21.50	19.63	19.94	18.69	24.92

Notes and Sources:

1. Data from reg9398.xls, provided in USPS-LR-I-107.
2. At most 16 combinations of activities are possible. Over the period of investigation, no more than 13 combinations are observed, and no more than 12 occur in any fourth quarter.

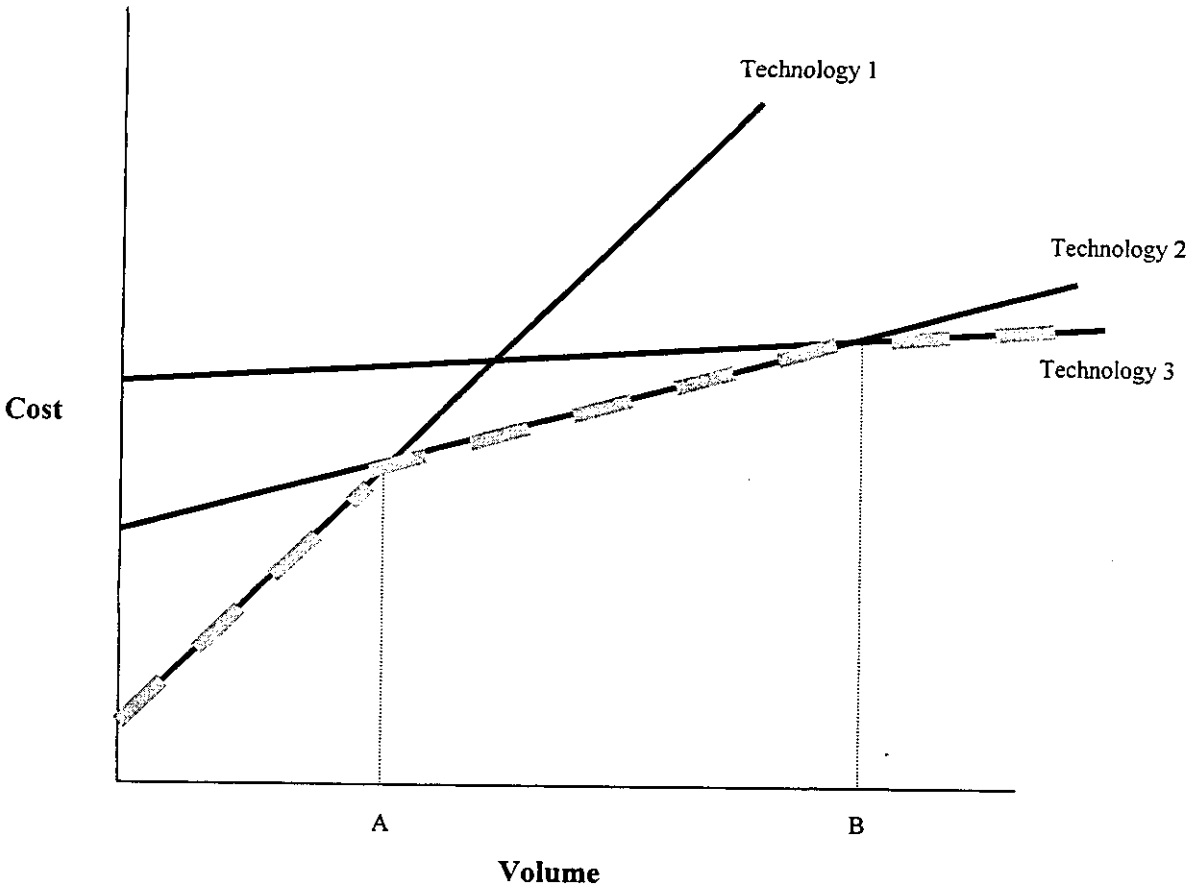
Four MODS activities are involved in the processing of letters: OCR, LSM, BCS, and Manual. These four activities yield 16 possible combinations of activities, of which only twelve are actually observed at the end of a year. The most noteworthy trend in letter processing is the gradual shutdown of letter processing machines. By the end of the period shown, these are quite rare. Apart from this change, trends are difficult to discern. A number of implausible combinations occur sporadically and at low frequencies. For example, instances appear in which a site reports activity for an optical character reader without a bar code sorter being present. Such combinations probably reflect data errors consisting of either failure to report numbers for activities present and in operation, or reporting numbers under the wrong codes. I will discuss the subject of data errors in more detail below.

Flats are processed either manually or with the help of sorting machinery. Over the period we see increasing reliance on mechanized processing, and a gradual decline in the proportion of sites relying entirely on manual processing. The small number of sites showing only mechanized processing may once again represent data errors.

The picture we see in connection with parcels mirrors that seen in connection with flats, but with a more marked trend over time. The number of sites relying solely on manual processing declines substantially over the period, and, obviously, there is a corresponding increase in the number of sites with mechanized processing.

A cost minimizing provider of mail processing services can be expected to alter systematically its procedures for processing mail in response to changes in mail volumes. The economic rationale behind such changes is shown graphically in Figure 1.

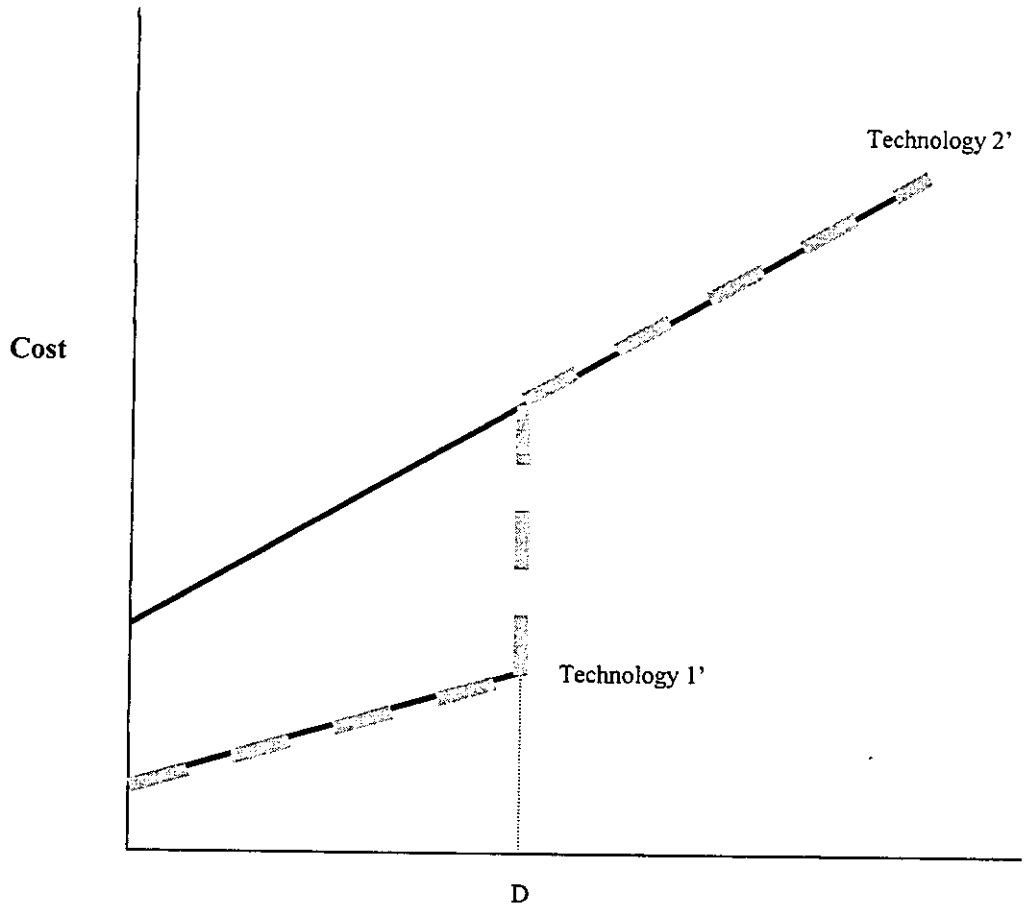
Figure 1: Technology Switching I



This figure depicts the costs of three different idealized mail processing technologies. In this example, a processing technology is characterized by a fixed setup cost that is independent of the volume of mail processed, and a variable component that reflects a constant per piece processing cost. Technology 1 has low setup costs, but high variable costs. Technology 3 is the reverse, with high fixed costs and lower variable costs. Technology 2 occupies an intermediate position. For mail volumes between 0 and A, technology 1 has a lower total cost than either of the other two technologies. For volumes falling in the range from A to B, technology 2 is the cost minimizing choice. For volumes above B, technology 3 is optimal. The final relationship between costs and volumes that results from these technology choices is shown by the dotted line.

The example shown in Figure 1 depicts a situation in which costs rise less than proportionately with volume, but this result is by no means guaranteed. Figure 2 depicts a different situation in which technology 1' has low costs, but can accommodate only volumes less than or equal to D . To accommodate volumes above D, one must switch to a different and higher cost technology that is labeled 2' in the figure. Such a situation could easily arise as the result of a reliance by technology 1' on a scarce factor of production. In this example, the final relationship between costs and volumes is shown by the dotted line, which depicts a situation in which there are diseconomies of scale.

Figure 2: Technology Switching II



In fact, the available data show a systematic relationship between the mix of activities present at a plant and the volume of mail that it processes. I have conducted a series of simple econometric analyses of this relationship for flats and for parcels. The results of these analyses are shown in Table 3.

Table 3
Automation in Response to Volume Growth

Dependent Variable = 1 if Facility has FSM Technology	Logit	Conditional Logit Fixed Effects
ln(TPH)	5.842	7.407
	(0.241)	(1.601)
Pseudo R2	0.627	
Sample	4843	168

Dependent Variable = 1 if Facility has SPBS Technology	Logit	Conditional Logit Fixed Effects
ln(TPH)	3.240	3.347
	(0.112)	(0.330)
Pseudo R2	0.800	
Sample	3912	691

Notes and Sources:
1. Data from reg9398.xls, provided in USPS-LR-I-107.
2. Models estimated using Maximum Likelihood. Standard errors shown in parentheses.
3. The logit model is estimated on the full analysis sample and the probability of having a technology is a function of ln(TPH) and a constant.
4. The conditional logit uses only those panels in which technology switching occurs (i.e. panels where the dependent variable is neither all zeros or all ones).

The top panel of Table 3 shows results obtained by estimating binary logit models in which the dependent variable indicates whether or not flat sorting machinery is present at the site in the time period in question, and the independent variable is the natural log of the number of piece handlings in flats-related MODS pools. The first column shows the results obtained by fitting a simple binary logit model. The second

column shows the results obtained in a conditional logit model that includes site-specific fixed effects terms. The inclusion of fixed effects terms essentially sweeps cross-sectional comparisons out of the data, and relates the installation of flat sorting machinery at a site to trends in that site's flats volume. Both models show a highly significant relationship between volume and the decision to mechanize.

The bottom panel of Table 3 shows comparable results for parcel sorting. Here too, we find in both models a highly significant relationship between volume and the decision to install SPBS equipment.

The findings shown in Table 3 result from the expenditure of a great deal of econometric firepower to answer what is really a fairly simple and obvious question. It should come as no surprise to anyone involved in this proceeding that mechanization decisions are closely related to mail volume, and that mechanization is one of the important ways in which the Postal Service accommodates growth in mail volume.

(3) Construction, Expansion, or Modification of Mail Processing Plants

In his direct testimony, Mr. Degen dismisses a comment I offered during R97-1 in response to a question by Chairman Gleiman regarding the possibility that one of the ways in which the Postal Service might respond to growth in volume would be by building new processing plants.[11] Mr. Degen argues that this would not be a "rational response," because "the additional workload caused by an additional piece is

11. USPS-T-16, p. 17.

necessarily dispersed throughout the network."[12] The testimony offered by other Postal Service witnesses appears to contradict Mr. Degen's assertion.

Ms. Kingsley provides a detailed description of the Postal Service's approach to space planning in which she identifies the acquisition of new space as a measure of last resort:

> The ideal configuration for distribution is centralized distribution within an existing plant, utilizing existing plant space to the fullest. When existing plant space is inadequate, the second option is to decentralize some processing operations into existing postal space outside of the plant. The third option is to change mail flows to reduce workload and thus space required for the workload. New processing space is obtained only as a last resort.[13]

Ms. Kingsley goes on to describe in more detail the ways in which the Postal Service alters or decentralizes its operations in an effort to maintain operations within its existing network of facilities. She concludes this discussion by flatly stating: "When these options still do not produce enough space, new space must be obtained."[14]

Dr. Bozzo has testified that his analysis includes five new facilities that came on line during the 6 year period covered by his data, plus another eight existing facilities that were added to the MODS system, suggesting a change in the scale of those facilities. He states his understanding that "additions of facilities to MODS are most commonly related to expansions of the facilities to include automated sorting

12. USPS-T-16, p. 17.
13. USPS-T-10, p. 33.
14. USPS-T-10, p. 33.

equipment."[15] Thus, according to Dr. Bozzo, either five or thirteen new facilities were added to the system, depending upon how one defines "new."

Even Mr. Degen describes the construction of new processing plants by the Postal Service to accommodate changes in volume:

> This is not to say that the Postal Service network is static. It has evolved over time as the nation has grown and its population distribution has changed, and as mail processing technology has progressed. It continues to evolve, albeit slowly. For example, between FY1993 and FY1996 (the R94-1 and R97-1 Base Years) the Postal Service added two new 3-digit zip codes, in addition to the 912 in use previously. During this same period it added five new mail processing plants – averaging just over one plant a year – each built to handle a portion of an existing plant's service territory. During this same period it also replaced 20 existing plants with new ones, and expanded or rehabilitated another three.[16]

Mr. Degen is correct in emphasizing the interconnectedness of the Postal Service's network, and the constraints that places on the ability of the Postal Service to build and integrate new plants. However, the record demonstrates clearly that the Postal Service has been successful in overcoming those constraints. Mr. Degen's assertion that the construction of new plants plays no part in the response of the Postal Service to an increase in mail volume is simply wrong.

CRITICISMS OF DR. BOZZO'S ANALYSIS

(1) Overview

Dr. Bozzo presents the results of a statistical analysis aimed at measuring the extent to which mail processing labor costs vary with volume. Historically, the Commission has held that mail processing labor costs are 100 percent volume variable.

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15. Response of Bozzo to UPS/USPS-T15-18, Tr. 15/6389.
16. USPS-T-16, pp. 14-15.

In other words, the treatment of these costs has reflected the Commission's view that they vary in direct proportion to changes in the volume of mail being processed. In R97-1, the Postal Service introduced a new econometric study purporting to show that the volume variability of mail processing costs was well below 100 percent. This study was heavily criticized and was ultimately rejected by the Commission in that case. Dr. Bozzo's updated version of Professor Bradley's R97-1 study again finds that the volume variability of mail processing labor costs is well below 100 percent for many cost pools, although Dr. Bozzo's variabilities are generally higher than those found by Professor Bradley.

Dr. Bozzo begins his analysis by discussing the Commission's and intervenors' criticisms of the R97-1 study. He discusses the concerns expressed in R97-1 about the appropriate "length of run" for such a study, and about selection bias due to Dr. Bradley's use of ad hoc sample selection criteria. Dr. Bozzo's numerous changes to Dr. Bradley's model specifications, data "scrubbing" procedures, and data sources reflect Dr. Bozzo's efforts to respond to criticisms of the original study. Nonetheless, Dr. Bozzo has in large part accepted Dr. Bradley's original conceptual and empirical framework.

Following Dr. Bradley's R97-1 approach, Dr. Bozzo specifies separate translog regression equations for each of a number of MODS cost pools. Once again, he takes labor hours rather than costs as the dependent variable for his equations, and "piece handlings" rather than mail volume as his cost driver.[17] He retains the time trend and

17. Dr. Bozzo has selected a cost driver that is slightly different from that used by Dr. Bradley. For a number of the activities he examines, he uses Total Pieces Fed ("TPF") in place of the Total Piece Handlings ("TPH") measure used by Dr. Bradley. The latter measure counts the number of mail pieces successfully

manual ratio variables included in Dr. Bradley's original specification. To these he adds a number of new regressors: a facility-level measure of installed capital; a measure of the number of delivery points served by the facility; and a measure of the wages paid to mail processing employees. Dr. Bozzo's study is also much narrower in scope than Dr. Bradley's R97-1 investigation. In contrast to the previous study, Dr. Bozzo's testimony presents variability results only for ten direct MODS activities. No results are presented for MODS allied activities, or for BMC mail processing activities.

Dr. Bozzo finds volume variabilities to be significantly lower than 100%, suggesting that mail sortation exhibits increasing returns to scale. His elasticity estimates are lowest for the manual operations, Manual Parcels, Manual Flats, and Priority. They are highest for the automated/mechanized operations, Optical Character Reader ("OCR"), Letter Sorting Machine ("LSM"), Bar Code Sorter ("BCS"), Flat Sorting Machines ("FSM"), and Small Package and Bundle Sorter ("SPBS"). Curiously, Dr. Bozzo's variabilities indicate that manual operations exhibit greater economies of scale than automated operations.

Unfortunately, Dr. Bozzo dismisses many serious concerns raised with respect to Dr. Bradley's R97-1 study. Despite Dr. Bozzo's vigorous defense of the quality of the MODS data, the evidence presented in his testimony again provides ample reason for continuing concern about the errors that infect the data and the effects of those errors on variability estimates. Moreover, Dr. Bozzo continues to rely on piece handlings as a

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sorted, while the former includes the total number of pieces fed into the machine. Thus, the two measures differ by the number of pieces rejected by the machine.

cost driver, despite the concerns raised in R97-1 regarding the ability of this measure to serve as a proxy for volume. As I demonstrate below, these concerns are well founded.

In addition, Dr. Bozzo continues to analyze each activity in isolation, largely ignoring the fact that they are housed in the same facilities, operated in many instances by the same personnel, and in many cases serve as actual or potential substitutes for one another. One of the arguments advanced by Dr. Bozzo in support of his decision to base his analysis on each MODS cost pool in isolation is that "the cost pools can be defined such that they represent distinct (intermediate) production processes with separate, identifiable, and relatively homogenous inputs (e.g., labor services) and outputs (processed pieces, or TPF)."[18] He asserts, in effect, that each of the activities he has defined can be studied in complete isolation, ignoring entirely its interactions with other activities carried out within the same mail processing plant. He offers no evidence in support of this assertion. In fact, it is inconsistent with the descriptions of mail processing operations provided by the Postal Service's operational witnesses.

Mr. Degen and Ms. Kingsley both testify that staffing levels in opening units are driven by the need to get mail into downstream operations in order to carry out necessary processing within the available time window.[19] This example demonstrates one particular way in which different MODS activities interact and influence one another. It is not difficult to find other such examples.

Many facilities possess parallel processing operations for particular mail streams. Letters, flats, and parcels can all be sorted manually, or with the aid of automated

18. USPS-T-15, p. 43.

19. USPS-T-16, p. 47; USPS-T-10, pp. 28-32.

equipment. It seems highly unlikely that the operations of these parallel processing activities would not be affected by the way in which mail is allocated between them. Mr. Degen describes the highly dynamic way in which these allocation decisions are made.[20] Mail can be sorted manually because that is the only type of sortation carried out within the plant, because the physical characteristics of the mail do not lend themselves to mechanized processing, because the automated equipment is being used to full capacity, or because a batch of mail has arrived too late in the shift to accommodate the setup times needed for mechanized processing. It is reasonable to expect substantial differences in the operation of the manual sorting activity depending upon which of these reasons motivates its use.

Many of the mail streams within a plant undergo sequential processing steps. The layout, staffing, and organization of these steps must be determined in such a way as to provide for the smooth and efficient flow of mail through the entire system. Uncertainties in when and how much mail arrives at the plant will create at times temporary inventories of unprocessed mail. Does it make sense to process mail immediately, or to hold it until enough accumulates to permit efficient batch processing? This decision depends upon the total volume of mail to be processed, and the capacities and processing rates of all of the stages in the processing stream.

It is also reasonable to expect interactions between activities simply because of the fact that they are housed in the same plant and rely upon a shared workforce. In a crowded facility, a high volume of mail in one activity could create congestion that affects the operation of otherwise unrelated activities. A drop in volume for one mail

20. USPS-T-16, pp. 18-19.

stream could create a temporary labor surplus in the plant that could alter the mix of automated and manual processing for a different mail stream.

For all of these reasons, I would expect the different sorting activities within a plant to interact in numerous ways that Dr. Bozzo's study simply ignores.

Finally, although Dr. Bozzo has attempted to interpret his cost equations as labor demand functions, the microeconomic foundations for his analysis remain incomplete and confused. Dr. Bozzo's analysis treats as "control variables" many aspects of mail processing that in fact are under the control of the Postal Service and that can be expected to change in response to a shift in volume. In many cases this treatment is implicit. In some cases it is stated explicitly, and then generally defended with an assertion that the changes in question occur over too long of a time to be relevant. Rarely does he provide evidence to support such assertions. Often the available evidence contradicts them.

A few examples suffice to make the point:

- His analysis includes as an explanatory variable an index of the amount of capital at a facility. His variability estimates are thus calculated holding capital investment constant, whereas the amount of capital investment in a particular plant is influenced by the volume of mail handled by that plant.
- His analysis is carried out conditional on a MODS activity being present at a facility. The decision to install a new activity at a facility occurs outside of his analytical framework, even though that decision is often influenced by the amount of volume which the plant handles.
- In a similar way, his analysis is carried out conditional on the facility itself being present. Thus, construction of new facilities occurs outside of and is ignored by his analysis.

For all of these reasons, I remain as skeptical of Dr. Bozzo's results as I was of Dr. Bradley's R97-1 results. However, while my earlier criticisms of Dr. Bradley's work

were largely conceptual and methodological, I am now able to present empirical results documenting the validity of my concerns and the infirmities in Dr. Bozzo's approach.

(2) Dr. Bozzo Has Not Allayed Concerns About MODS Data Quality.

Dr. Bozzo admits that there exist large errors in the MODS data, particularly with those relating to operations. However, he dismisses the concerns expressed in R97-1 over data quality by arguing first that the noise in the MODS data are acceptable relative to other survey data, and second that, in any case, the effects of measurement errors are attenuated by the inclusion of site-specific fixed effects in the estimation. I address each of these points in turn.

Dr. Bozzo argues that overall data quality is acceptable by citing a survey of the statistics literature that describes data with errors of one to ten percent as "routine data," and data with a few percent errors as "average quality" data.[21] He explains that "[e]xcluding the manual parcels and manual Priority Mail operations, . . . [his threshold and productivity scrubs] identify between 0.6 percent and 7.1 percent of the raw MODS observations as erroneous."[22] However, as he implies, a significantly higher proportion of observations on manual operations are identified as erroneous by his threshold and productivity scrubs. In particular, as Table 4 shows, 13 percent of the manual flats observations, 22 percent of the manual parcels observations, and 15 percent of the Priority Mail observations in Dr. Bozzo's "non-missing" samples are erroneous. Moreover, these numbers actually understate the degree of error because they do not count as erroneous those observations with erroneously recorded zero piece

21. USPS-T-15, p. 106.
22. USPS-T-15, p. 106.

handlings.[23] Inspection of Dr. Bozzo's data suggests that the problem of falsely recorded zeros is widespread for a number of the MODS activities he examines.

Table 4
MODS Data Quality

MODS Group	Non-Missing	Threshold	Threshold and Productivity	% of Observations Exhibiting Gross Data Errors
BCS	6885	6883	6780	1.53%
OCR	6644	6639	6495	2.24%
FSM	5442	5442	5424	0.33%
LSM	5156	5150	5127	0.56%
Manual Flats	6914	6914	6033	12.74%
Manual Letters	6914	6914	6667	3.57%
Manual Parcels	5835	5625	4545	22.11%
Priority	5717	5644	4864	14.92%
SBPS	2244	2239	2213	1.38%
Metered Cancellations	6746	6718	6579	2.48%

Notes and Sources:

1. Data from USPS-T-15, p. 107.
2. Because Dr. Bozzo records both true missing values and bad data as zeros, these data underestimate the percent of gross errors.

(a) Data Problems in the Manual Parcels Series

A careful look at the manual parcels series for piece handlings suggests the presence of serious data errors. In particular, this series appears to exhibit frequent gaps in reporting. I define a "gap" in reporting as a pattern in the data series in which a period with zero piece handlings for a particular site is both preceded by and followed by positive entries. Consider for example Site # 6, which shows positive piece handlings for Manual Parcels from the first quarter of 1993 to the first quarter of 1994, zero piece handlings from the second quarter of 1994 to the second quarter of 1995,

23. In Dr. Bozzo's dataset, a zero can in fact signify either a true zero – a situation in which labor hours or piece handlings were equal to zero -- or a missing value. Missing values correspond to situations in which the activity in question was present and in operation but, for some unknown reason, the data were not entered into the system.

and then positive piece handlings again. Taken at face value, these data would have the unrealistic implication that Site #6 did not process any mail through Manual Parcels for one calendar year.

In response to interrogatory UPS/USPS-T-15-13, Dr. Bozzo stated that MODS data for Manual Parcels are manually logged. Tr. 15/6387. The logging process is labor intensive, and as a result, it appears that data are often simply not entered into the system. For Site #6 in particular, Dr. Bozzo indicates that the gaps in the data series correspond to periods where data for the SPBS and Manual Parcels MODS activities were commingled and reported together as data for the SPBS MODS group. This suggests that both the SPBS and the Manual Parcels data series are individually noisy, and that the distinction between the two pools cannot be relied upon. Combining them into a single Parcels category is a way of dealing with the reporting error problem.

As shown in Table 5, a systematic search for gaps in the manual parcels series revealed a total of 46 gaps, with an average gap length of five quarters, suggesting a total of 230 observations with gross data error. In this same series, Dr. Bozzo's threshold and productivity scrubs detect the presence of another 1,290 observations with data errors. Moreover, given the nature of the manual data entry problems cited by Dr. Bozzo, it is possible that these series may contain other errors that are undetectable by the simple editing screens he uses.

Table 5

Intermittent Gaps in TPH

MODS Group	Number of Gaps	Average Gap Length
BCS	2	8
OCR	6	2
FSM	6	5
LSM	15	2
Manual Flats	4	2
Manual Letters	5	2
Manual Parcels	46	5
Priority	96	3
SPBS	6	6

Notes and Sources:

1. Data are from reg9398.xls, provided in USPS-LR-I-107.
2. A gap in the TPH series is defined as a series of non-positive values both preceded and followed by positive values.

(b) Data Problems in the Priority Mail Series

A careful look at the Priority Mail series for piece handlings also suggests the presence of serious data errors. In response to UPS/USPS-T-15-13, Dr. Bozzo stated that MODS data for Priority Mail, like Manual Parcels, are manually logged.[24] For Site #6, he explains that a gap in the Priority Mail data series reflects "a period prior to the filling of a related in-plant support position."[25]

A systematic search for gaps in this series revealed 96 gaps (see Table 5, above), with an average gap length of three quarters, suggesting a total of 288 observations with data errors. In addition, Dr. Bozzo's threshold and productivity scrubs detect the presence of another 853 observations with data error. Furthermore, as with

24. Tr. 15/6387.
25. Tr. 15/6387-88.

Manual Parcels, these data series are likely to have other errors that are undetectable by simple screens.

(c) Implications for Econometric Results

Measurement error in an explanatory variable of a linear regression model renders the estimator inconsistent and frequently biases coefficient estimates towards zero. Dr. Bozzo himself explains that the likely reason his variabilities for Manual Parcels and Priority Mail are considerably higher than those reported by Dr. Bradley in R97-1 is that the newer results reflect the use of tighter selection criteria to eliminate unusable observations. It is clear, however, that errors remain in Dr. Bozzo's data, despite his use of tighter selection criteria. This fact suggests that the relatively low volume variabilities he reports for the manual operations may be attributable to this remaining measurement error rather than to true economies of scale.

(d) Dr. Bozzo's Fixed Effects Estimator Does Not Solve the Data Quality Problems.

Although Dr. Bozzo concedes that the manual piece handling data series (at least for parcels) continue to be subject to measurement error even after his scrubs, he argues that the nature of the measurement error is such that it is not of concern. In particular, he asserts that the measurement error is likely to vary systematically across sites,[26] and he claims that therefore the inclusion of site-specific effects in the panel fixed effects model attenuates this errors-in-variables problem. Dr. Bozzo says, ". . . models such as fixed effects . . . are completely effective at controlling for omitted factors associated with sites and/or time periods, when panel data are available."[27]

26. USPS-T-15, p. 85.

27. USPS-T-15, p. 104.

While Dr. Bozzo's reasoning may be true for site-specific errors that are fixed over time, there is good reason to believe that, in fact, the site-specific errors change over time.

To understand why site-specific errors in data entry may change over time, consider again the case of parcel sorting. One type of error found in the data is the inadvertent commingling of Manual Parcel piece handlings and the SPBS piece handlings data. This type of error is possible only if the facility operates an SPBS sorting machine. In fact, 26 percent of sites acquired SPBS technology at some point after the start of the analysis sample. Certainly, for these sites any site-specific error that commingles data for SPBS and Manual Parcels begins only after the adoption of the mechanized technology. More generally, it is plausible to expect that at a given facility the burden of manually logging data increases over time with mail volume.

The piece counts for many manual activities are derived by weighing mail and applying national conversion factors to convert these weights into item counts. As Dr. Bozzo notes, local variations in weight per piece would cause this estimation process to yield erroneous results.[28] He notes that weight per piece will vary from site to site, but he ignores the fact that it may also vary over time. A trend over time in weight per piece will impart a false trend in the estimates of piece handlings. That false trend is capable of distorting Dr. Bozzo's volume variability estimates.

When site-specific measurement error changes over time, fixed effects estimation cannot solve the errors-in-variables problem. In such cases, measurement error destroys the favorable statistical properties of all of the estimators considered by Dr. Bozzo. In particular, the fixed effects, the random effects, and the pooled estimators

28. USPS-T-15, p. 86.

will all be inconsistent. Moreover, the pattern of change in Manual Parcels and SPBS from Dr. Bradley's study in R97-1 to Dr. Bozzo's study as well as my own calculations suggest that the estimated variabilities are likely to be biased downward.

(3) Dr. Bozzo Erroneously Continues to Rely on Piece Handlings as a Proxy for True Volume.

Postal ratemaking procedures require estimates of the elasticities of various costs with respect to subclass-specific volumes of mail delivered. Because the number of subclasses is very large, direct estimation of these cost elasticities is often not feasible. As a result, most Postal Service costing studies rely on the cost driver/ distribution key approach in which the required elasticities are estimated in a two-step process. The first step in this process involves estimating the elasticity of the costs in question with respect to a "cost-driver." In the second step, the shares of the cost driver accounted for by each subclass are combined with the estimated elasticity to arrive at the required subclass-specific cost elasticity.

There are a number of assumptions implicit in the cost driver/distribution key approach. The first is that the cost driver captures the essential cost-causing characteristics of the various subclasses. For example, in the case of purchased highway transportation, the cost driver is the number of cubic foot miles of mail carried. The greater the number of cubic foot miles carried, the greater are purchased highway transportation costs. To measure the contribution of a particular subclass to purchased highway transportation costs, all one need know is the number of cubic foot miles associated with that subclass.

The second key assumption is that the cost driver changes in direct proportion to the volume of mail carried. This assumption is referred to by Dr. Bozzo as the "proportionality" assumption.[29] Pursuing further the example cited above, this assumption requires that if the volume of a particular subclass of mail were to double, the number of cubic foot miles associated with it must also double.

In R97-1, I criticized Dr. Bradley for his reliance on "piece-handlings" as a cost driver in his study of mail processing labor costs. At that time, I noted that what is required for ratemaking purposes is the elasticity of mail processing costs with respect to ***volume***, and that piece handlings is a measure that is conceptually distinct from volume. Volume is measured by the number of pieces of mail tendered for delivery, or, alternatively, by the number of pieces of mail delivered (these two should hopefully be equal). A piece handling, however, is generated each time a piece of mail at a specific site is processed in a particular sorting activity. Thus, in the vast majority of cases, a single piece of mail will generate many piece handlings as it makes its way from its origin to its destination. The proportionality assumption requires that, on average within a subclass, each additional piece of mail generates the same number of additional piece-handlings. In R97-1, I pointed out that Dr. Bradley had presented no empirical evidence regarding the validity of this crucial assumption.

Dr. Bozzo's study is equally silent on the subject. In his written testimony, Dr. Bozzo discusses and dismisses my R97-1 criticism on this point. In the course of this discussion he offers a number of arguments, none of which is fully convincing.

29. USPS-T-15, p. 53.

The first of these arguments is essentially a "it's not my problem" argument. He correctly notes that even if it were the case that piece handlings and volume were not proportional, this would not necessarily mean that the elasticity of labor hours with respect to piece handlings had been measured incorrectly.[30] Although true, this observation is disingenuous. What is required for ratemaking is an estimate not of a piece handling variability, but rather of a volume variability.

The second of these arguments is that the proportionality assumption simplifies the calculation of the required subclass-specific volume variabilities. This argument is equally true and equally disingenuous. It would be even simpler for the Postal Service to dispense with the whole cost driver/distribution key approach and retain the traditional finding that mail processing labor costs are 100 percent volume variable. The Postal Service, however, apparently believes this finding to be untrue, and has presented Dr. Bozzo's much more complicated study because it believes its results to be closer to the truth. This decision demonstrates an obvious principle: simplicity alone is not enough to justify a critical assumption; in addition, the assumption must be true.

The third argument offered in support of the proportionality assumption rests upon the multi-year nature of national deployments of new equipment and adoption of major operational changes.[31] It may be inaccurate to characterize Dr. Bozzo's statements in this context as an argument, since his reasoning is not fully set forth. He seems to suggest that because major deployments of new equipment take time, their effects on the relationship between volume and piece handlings should be disregarded.

30. USPS-T-15, p. 52.

31. USPS-T-15, p. 55.

If this is his argument, I find it unconvincing. I would expect the installation of major new pieces of equipment at a particular plant to have potentially substantial effects on mail processing operations at that site. Many of the deployments to which he refers involve dozens or hundreds of such sites.[32] Over the span of a few years such deployments could have drastic effects. Ultimately, the question of whether or not these effects should be disregarded is one that should be answered empirically.

I have conducted an empirical investigation of the relationship between the volume of mail processed at a plant and the number of piece handlings at that plant. My results show that an increase in volume causes a disproportionate increase in piece handlings. Those results validate the criticisms I made in R97-1. Thus, my criticisms in R97-1 apply equally to Dr. Bozzo's current study.

There are at least two obstacles to estimating the elasticity of cost with respect to volume at the facility level. The first is that true volume can only be measured at the system level, not at the facility level. There is, however, a volume-like measure available at the facility level: first handling pieces ("FHP"). First handling pieces counts the unique number of mail pieces entering the facility. Thus, FHP is a conceptually attractive measure of volume at the facility level. The second problem, however, is that FHP is known to be a very noisy measure of volume. FHP is not a physical count of the number of mail pieces entering a facility; rather, it is a weight-imputed count. Facilities use national weight conversion factors to convert weights to pieces, by shape. Because of the known pitfalls of using poor quality data as control variables, there is general agreement that FHP ought not be used as the measure of volume.

32. ANM/USPS-T10-34, Tr. 5/1584.

I investigated the relationship between FHP and piece handlings ("TPH/F") using the data provided by Dr. Bozzo in USPS-LR-I-186. These data, like the data on TPH/F, are presented by site and by quarter, for each of the MODS groups. I merge the FHP data with the original data provided by Dr. Bozzo in his workpapers and modify the sample selection criteria to include checks on FHP. In particular, I include an observation in the analysis sample if, along with Dr. Bozzo's other sample selection criteria, FHP is greater than zero and there are still a minimum of eight usable observations for the site to which the observation belongs.

To avoid the pitfalls of errors-in-variables bias, I estimate the elasticity of TPH/F with respect to FHP using the reverse regression of FHP on TPH/F and other variables, running separate regressions for each of eight MODS groups of interest and also for each of two shape categories. The reverse regression isolates the mismeasured variable FHP as the dependent variable. It is a well known result that measurement error in the dependent variable is absorbed in the error term and can be ignored.[33] The elasticity of interest, then, is computed as the reciprocal of the estimated marginal effect of ln(THP/F) on ln(FHP).

(a) MODS Pool-Level Analysis

In keeping with Dr. Bozzo's MODS-level analysis, I first estimate a MODS-level, log-log specification of the reverse regression, which includes as regressors the level and square of TPH/F, possible deliveries (DPT) as a measure of local network effects,

33. See William H. Greene, Econometric Analysis (2d ed. 1993), p. 281.

and a set of eighteen time dummies, one for each quarter excluding the second quarter of 1994. For each MODS group, the full estimating equation is:

$$\ln(FHP_{it}) = \alpha_i + \beta_1 \ln(THP / F_{it}) + \beta_2 \ln(TPH / F_{it})^2 + \beta_3 \ln(DPT_{it}) + \beta_4 TimeDummies_{it} + u_{it}$$

where the subscripts *i* and *t* index the site and time period, respectively. To investigate the importance of DPT and the time dummies, I also estimate a restricted model. The restricted estimating equation is:

$$\ln(FHP_{it}) = \alpha_i + \beta_1 \ln(THP / F_{it}) + \beta_2 \ln(TPH / F_{it})^2 + u_{it} .$$

Following Dr. Bozzo's approach, I estimate the parameters of both equations using panel fixed effects estimation with the modified Baltagi and Li's generalized least squares procedure, to allow the regression disturbances to exhibit first-order serial correlation.

Table 6 presents the estimated elasticities of TPH with respect to FHP, instead of the individual regression coefficients, for both specifications. The full set of regression coefficients is presented in Appendix D. Because of the problem of commingling of data between the manual parcels and SPBS pools, I combine them into a single composite parcels pool. F-tests uniformly find in favor of the full specification, indicating that local network characteristics and time specific effects are important determinants of the relationship between FHP and TPH. Moreover, the estimated marginal effects resoundingly reject the proportionality assumption. In every case, the estimated elasticity of TPH with respect to FHP is greater than one, and often by a very large margin.

Table 6

Estimates of the Elasticity of TPH with respect to FHP
Imputed from the Reverse Regression of FPH on TPH - MODS Level Analysis

MODS Group	Specification	AR1-Fixed Effects	Ho: Proportionality	F-Statistic	Pvalue
OCR	Full	1.597	reject	20.304	0.000
		(0.043)			
	Partial	1.386	reject		
		(0.030)			
LSM	Full	1.069	reject	6.446	0.000
		(0.030)			
	Partial	0.956	reject		
		(0.018)			
BCS	Full	2.091	reject	25.748	0.000
		(0.058)			
	Partial	1.560	reject		
		(0.027)			
Manual Letters	Full	1.229	reject	14.606	0.000
		(0.012)			
	Partial	1.174	reject		
		(0.010)			
FSM	Full	1.544	reject	56.969	0.000
		(0.027)			
	Partial	1.138	reject		
		(0.012)			
Manual Flats	Full	1.010	reject	9.000	0.000
		(0.008)			
	Partial	0.969	reject		
		(0.006)			
Parcels	Full	1.795	reject	7.692	0.000
		(0.099)			
	Partial	1.786	reject		
		(0.088)			
Priority	Full	1.013	reject	1.697	0.030
		(0.003)			
	Partial	1.010	reject		
		(0.002)			

Notes and Sources:

1. Data from fhp9398.xls and reg9398.xls, provided in USPS-LR-I-186 and USPS-LR-I-107, respectively.
2. Standard errors shown in parentheses.
3. Estimated effects are significantly different from zero and one at or below the 1% significance level.
4. Partial specification regresses ln(FHP) on ln(TPH) and the square of ln(TPH).
5. Full specification regresses ln(FHP) on ln(TPH), the square of ln(TPH), ln(DPT), and a set of 18 time dummies (one for each quarter, excluding the first one).
6. F-Tests (statistics and pvalues shown in table) uniformly favor the full specification.
7. Appendix C shows the full set of estimation results.

(b) Shapes-Level Analysis

Because FHP is calculated from mail weight using national weight conversion factors by shape, it may well be that the data are meaningful only at the shapes level, not at the MODS level. Thus, I estimate a shapes-level log-log specification of the reverse regression described above for letters and flats. The shapes-level analysis requires aggregation of the OCR, LSM, BCS, and Manual Letters MODS groups into Letters and the aggregation of FSM and Manual Flats into Flats.

Table 7 presents the estimated elasticities of TPH with respect to FHP, instead of the individual regression coefficients, for both specifications. The full set of regression coefficients are presented in Appendix D. As with the MODS-level analysis, F-tests uniformly find in favor of the full specification, indicating that local network characteristics and time-specific effects are important determinants of the relationship between FHP and TPH. Furthermore, the estimated marginal effects resoundingly reject the proportionality assumption. Aside from Priority, the point estimates indicate that total piece handlings increase considerably faster than first piece handlings. Elasticities of TPH with respect to FHP range from just over one for Priority to a high of 2.06 for letters.

Table 7

Estimates of the Elasticity of TPH with respect to FHP
Imputed from the Reverse Regression of FPH on TPH - Shapes Level Analysis

Shape	Specification	AR1-Fixed Effects	Ho: Proportionality	F-Statistic	Pvalue
Letters	**Full**	2.062	reject	14.148	0.000
		(0.061)			
	Partial	1.689	reject		
		(0.034)			
Flats	**Full**	1.318	reject	46.449	0.000
		(0.015)			
	Partial	1.078	reject		
		(0.009)			
Parcels	**Full**	1.795	reject	7.691	0.000
		(0.099)			
	Partial	1.786	reject		
		(0.088)			
Priority	**Full**	1.013	reject	1.697	0.030
		(0.003)			
	Partial	1.010	reject		
		(0.002)			

Notes and Sources:

1. Data from fhp9398.xls and reg9398.xls, provided in USPS-LR-I-186 and USPS-LR-I-107, respectively.
2. Standard error shown in parentheses.
3. Estimated effects are significantly different from zero and one at or below the 1% significance level.
4. Partial specification regresses ln(FHP) on ln(TPH) and the square of ln(TPH).
5. Full specification regresses ln(FHP) on ln(TPH), the square of ln(TPH), ln(DPT), and a set of 18 time dummies (one for each quarter, excluding the first one).
6. F-Tests (statistics and pvalues shown in table) uniformly favor the full specification.
7. Appendix D shows the full set of estimation results for Letters, Flats, and Parcels. Appendix C shows the full set of estimation results for Priority.

(4) Dr. Bozzo's Results Have Unreasonable Implications for the Efficiency of Manual Operations.

Dr. Bozzo's variabilities for manual operations are uniformly smaller than his variabilities for automated or mechanized operations, implying that manual operations exhibit economies of scale while mechanized or automated operations do not. This relationship implies that as volumes grow in both activities, costs grow less rapidly in manual activities, and thus that manual processing eventually becomes less expensive on a per piece basis than mechanized and automated activities. Such a result would be counter-intuitive. The Postal Service has pursued automation as a cost saving strategy. Since the move to mechanized or automated operations entails significant capital expenditures, it makes sense only if these capital costs are offset by lower per piece processing costs.

The anomaly caused by the presence of economies of scale in manual processing could be more apparent than real. It is possible that the per piece cost of processing a piece manually is substantially higher than the corresponding cost of mechanized processing, and that the per piece cost of manual processing declines slowly with growth in volume. One might, in such a case, never actually encounter a situation in which manual processing is actually the less costly option.

One can test the reasonableness of Dr. Bozzo's results by checking to determine whether manual processing ever actually is the lower cost option for any of the facilities in his sample. A result indicating that manual processing is less expensive on a marginal cost basis than mechanized or automated processing would raise serious questions about the validity of Dr. Bozzo's findings. I have conducted such a test, and

find that there are numerous instances in which manual processing is apparently the more economical option.

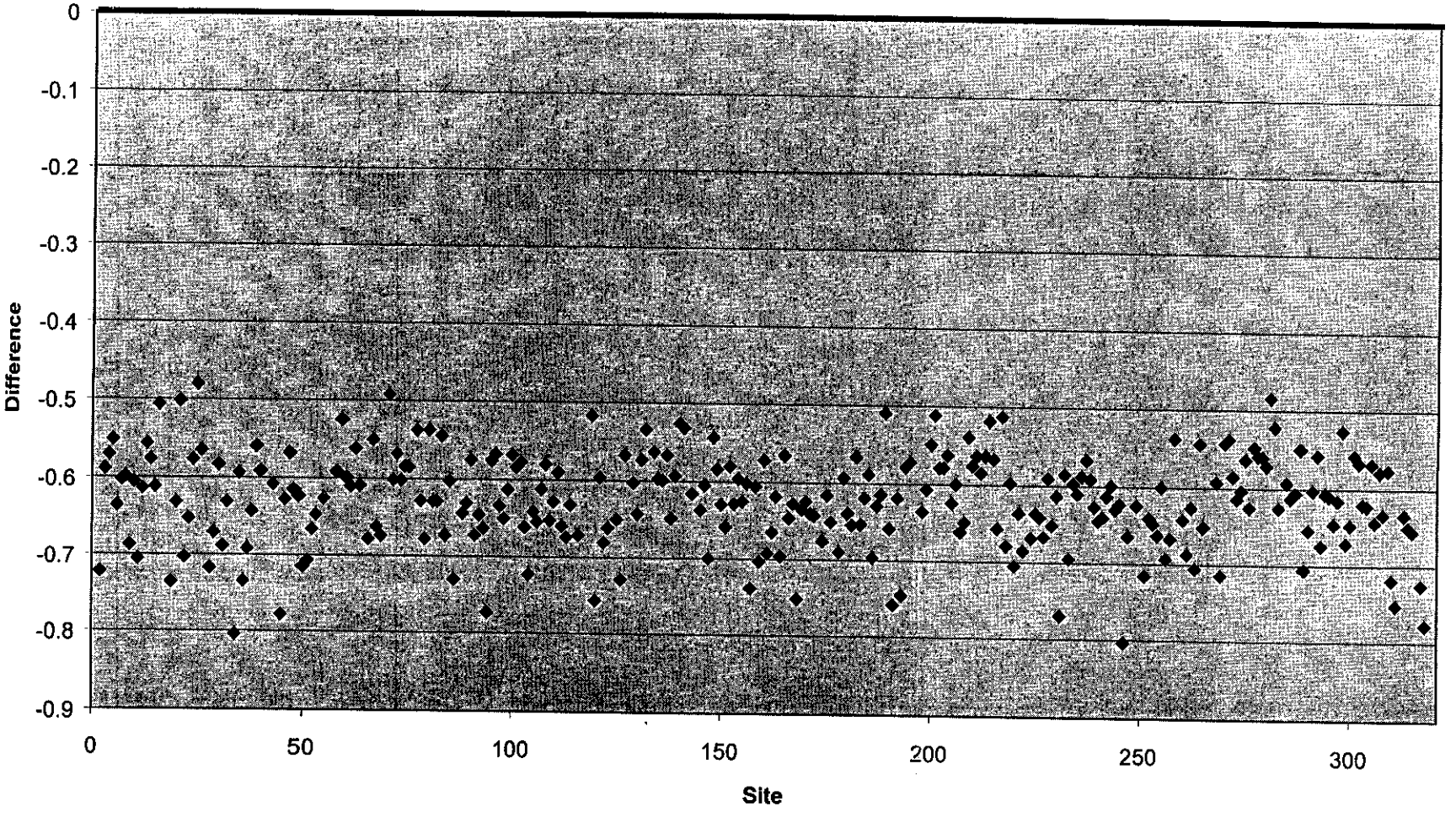
The necessary calculation of marginal cost is straightforward. The elasticity (ε) of labor costs (C) with respect to piece handlings (V) is equal to $\frac{dC}{dV}\frac{V}{C}$, where $\frac{dC}{dV}$ is the marginal cost (MC) of an increase in V. Marginal cost in a particular sorting operation *i* is given by $\hat{MC}_i = \hat{\varepsilon}_i \frac{\overline{C_i}}{\overline{V_i}}$, where *i* indexes the sorting operation, and $\overline{C_i}$ and $\overline{V}_i$ are average piece handlings and volume, respectively.

Using facility-specific 1998 piece handlings and volume data and Dr. Bozzo's estimated coefficients from his labor demand model, I calculate the marginal cost in 1998 for sorting operation *i* at facility *j* as: $\hat{MC}_{98,i,j} = \hat{\varepsilon}_{98,i,j} \frac{\overline{C_{98,i,j}}}{\overline{V_{98,i,j}}}$, where $\overline{C}_{98,i,j}$ and $\overline{V}_{98,i,j}$ are site-specific average piece handlings and volume, respectively.

To investigate the reasonableness of the pattern of implicit marginal costs across MODS groups, I compare the facility-level marginal cost of manual sorting relative to the marginal cost of automated/mechanized sorting by mail shape. In particular, I compare the marginal cost of BCS to Manual Letters, the marginal cost of OCR to Manual Letters, the marginal cost of SPBS to Manual Parcels, and the marginal cost of FSM to Manual Flats. These comparisons reveal the expected pattern for letters. In particular, I find that for each of the 282 facilities for which we have 1998 estimated elasticities, the marginal cost of processing a letter in BCS is well below the marginal cost of manual processing. Similarly, I find that for each of the 246 facilities in the comparison, the

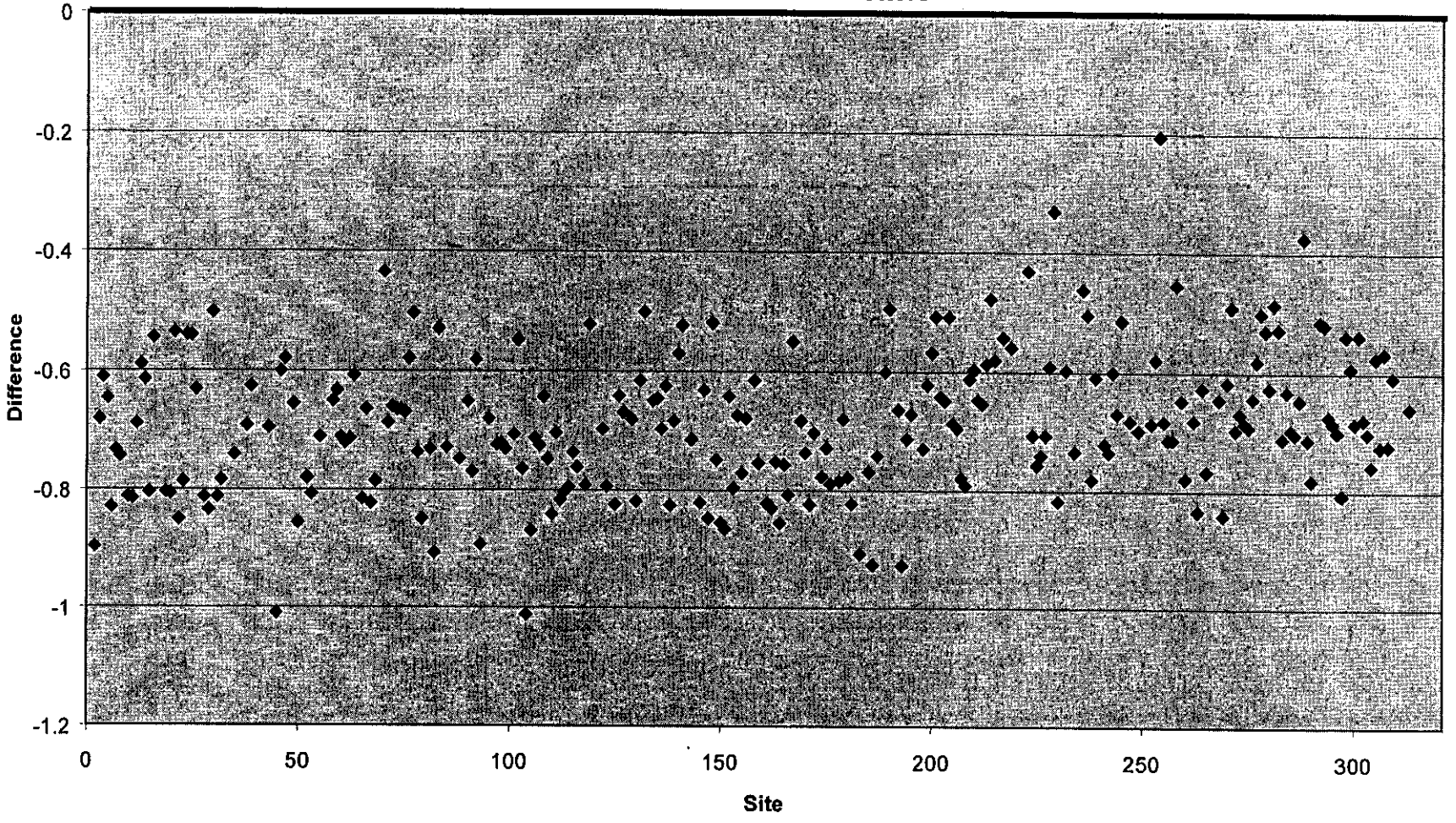
marginal cost of processing a letter in OCR is well below the marginal cost of manual processing. See Figures 3 and 4.

Figure 3
Comparison of the Implied Marginal Costs
of BCS and Manual Letters



Notes: The figure plots the difference between the ratio of manual to automated elasticities and the ratio of automated to manual average costs. For facilities below the zero line, the marginal cost of automated processing is lower than the marginal cost of manual processing. The figure contains data on 282 sites, none of which are above the zero line.

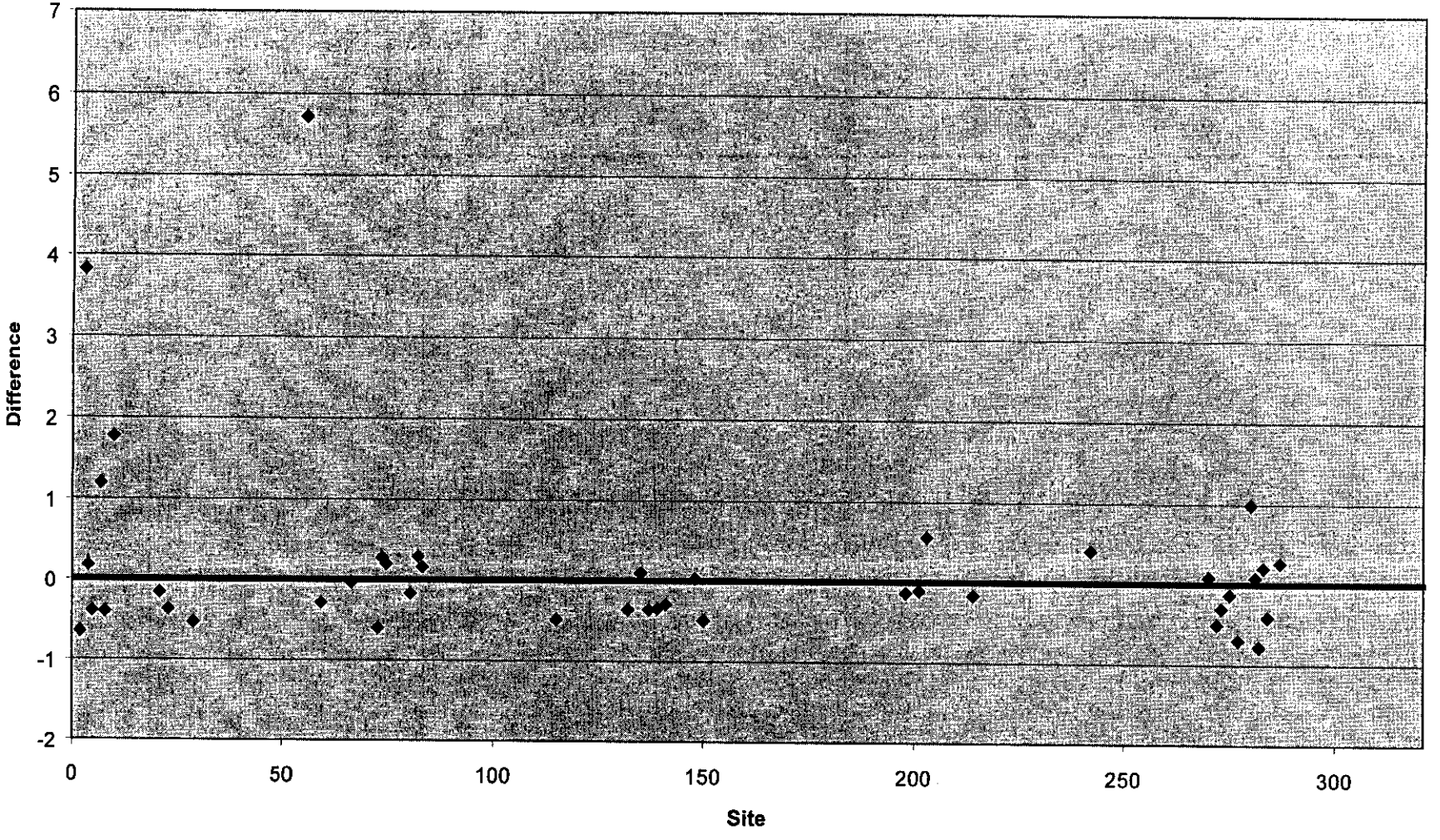
Figure 4
Comparison of the Implied Marginal Costs of OCR and Manual Letters



Notes: The figure plots the difference between the ratio of manual to automated elasticities and the ratio of automated to manual average costs. For facilities below the zero line, the marginal cost of automated processing is lower than the marginal cost of manual processing. The figure contains data on 246 sites, none of which are above the zero line.

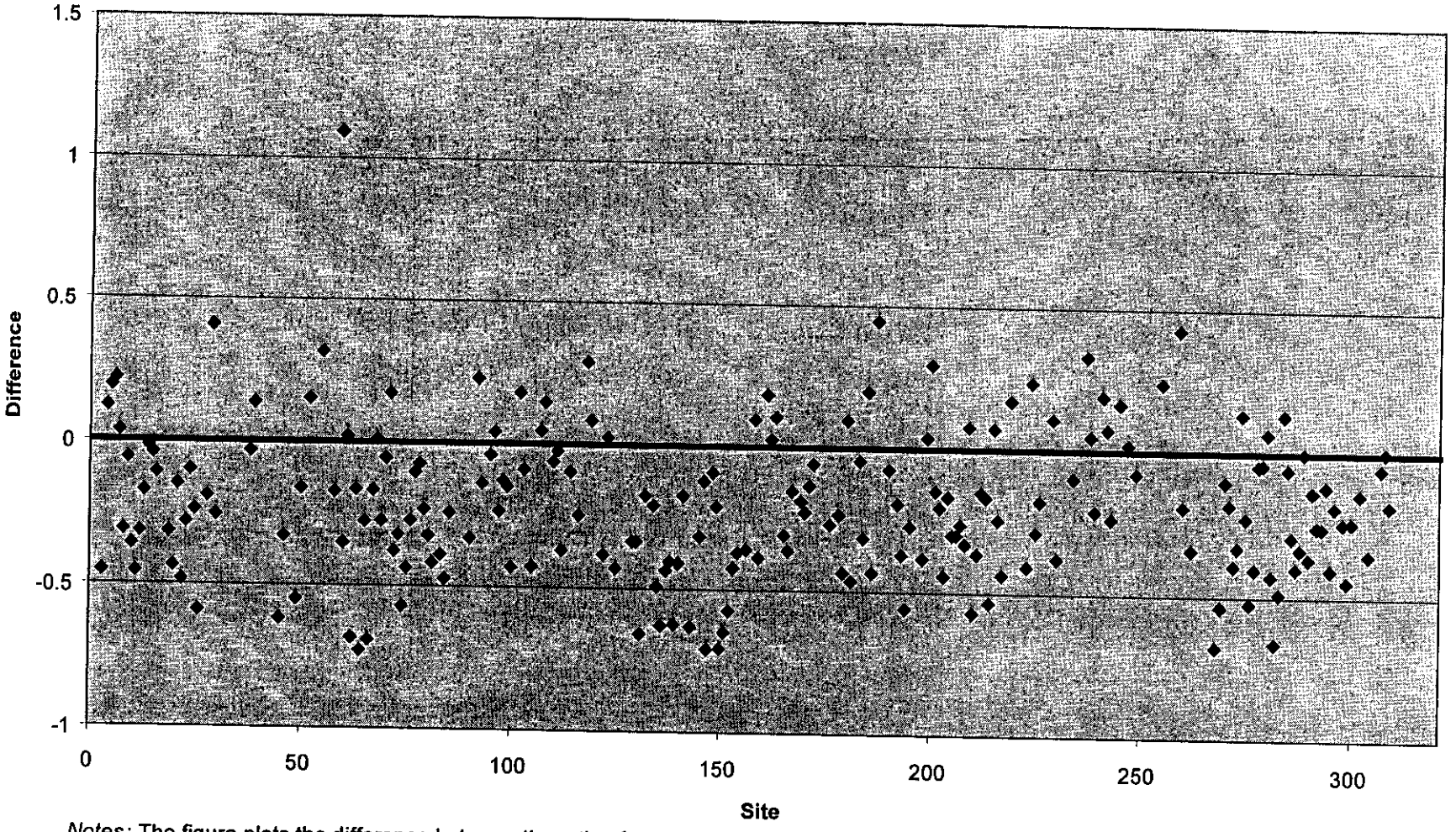
The comparisons for parcels and flats, however, reveal peculiar patterns. I find that for 42 percent of the facilities in the comparison, the marginal cost of manually processing a parcel is lower than the marginal cost of the mechanized SPBS technology. Consistent with previous conclusions, this investigation casts serious doubt on the reliability of the estimated elasticities for Manual Parcels and SPBS. I find that for 22 percent of the facilities in the comparison, the marginal cost of manually processing a flat is lower than the marginal cost of the mechanized FSM technology. This finding casts doubt on the reliability of the estimated elasticities of Manual Flats and FSM. Figures 5 and 6. I suspect that the large number of cases shown in these tables in which manual processing is apparently less expensive than mechanized or automated processing reflects downward bias in the estimated volume variabilities for manual operations.

Figure 5
Comparison of the Implied Marginal Costs
of SPBS and Manual Parcels



Notes: The figure plots the difference between the ratio of manual to automated elasticities and the ratio of automated to manual average costs. For facilities below the zero line, the marginal cost of automated processing is lower than the marginal cost of manual processing. The figure contains data on 43 sites, 42 percent of which are above the zero line.

Figure 6
Comparison of the Implied Marginal Costs
of FSM and Manual Flats



Notes: The figure plots the difference between the ratio of manual to automated elasticities and the ratio of automated to manual average costs. For facilities below the zero line, the marginal cost of automated processing is lower than the marginal cost of manual processing. The figure contains data on 213 sites, 22 percent of which are above the zero line.

MR. DEGEN'S CONCLUSIONS REGARDING VOLUME VARIABILITY OFTEN REST UPON FLAWED ARGUMENTS OR UNVERIFIED ASSUMPTIONS.

In this proceeding, Postal Service Witness Degen presents his "operational analysis" of mail processing on the basis of which he argues that volume variabilities "are generally less than 100 percent."[34] In this part of my testimony, I review his arguments and assess their validity. I consider carefully in the light of the available evidence the potential for volume specific diseconomies associated with the operation of a single mail sorting operation, for plant-specific diseconomies associated with the operation of an entire facility, and for system-wide diseconomies associated with the Postal Service's operation of multiple facilities.

Based on this analysis, I conclude that Mr. Degen's testimony should be approached with some caution and considerable skepticism. The operational arguments he offers for the presence of economies of scale are weaker than they first appear. In his effort to support Dr. Bozzo's study and argue for volume variabilities below 100 percent, Mr. Degen makes a number of important but implicit assumptions regarding the effects of increases in mail flow on mail processing operations. Often these assumptions are made without supporting evidence, and at times they are contradicted by available information. Frequently, the situation turns out to be considerably more complex than he makes it out to be. In this section, I explain in turn each of his principle arguments for the existence of economies of scale. I conclude that

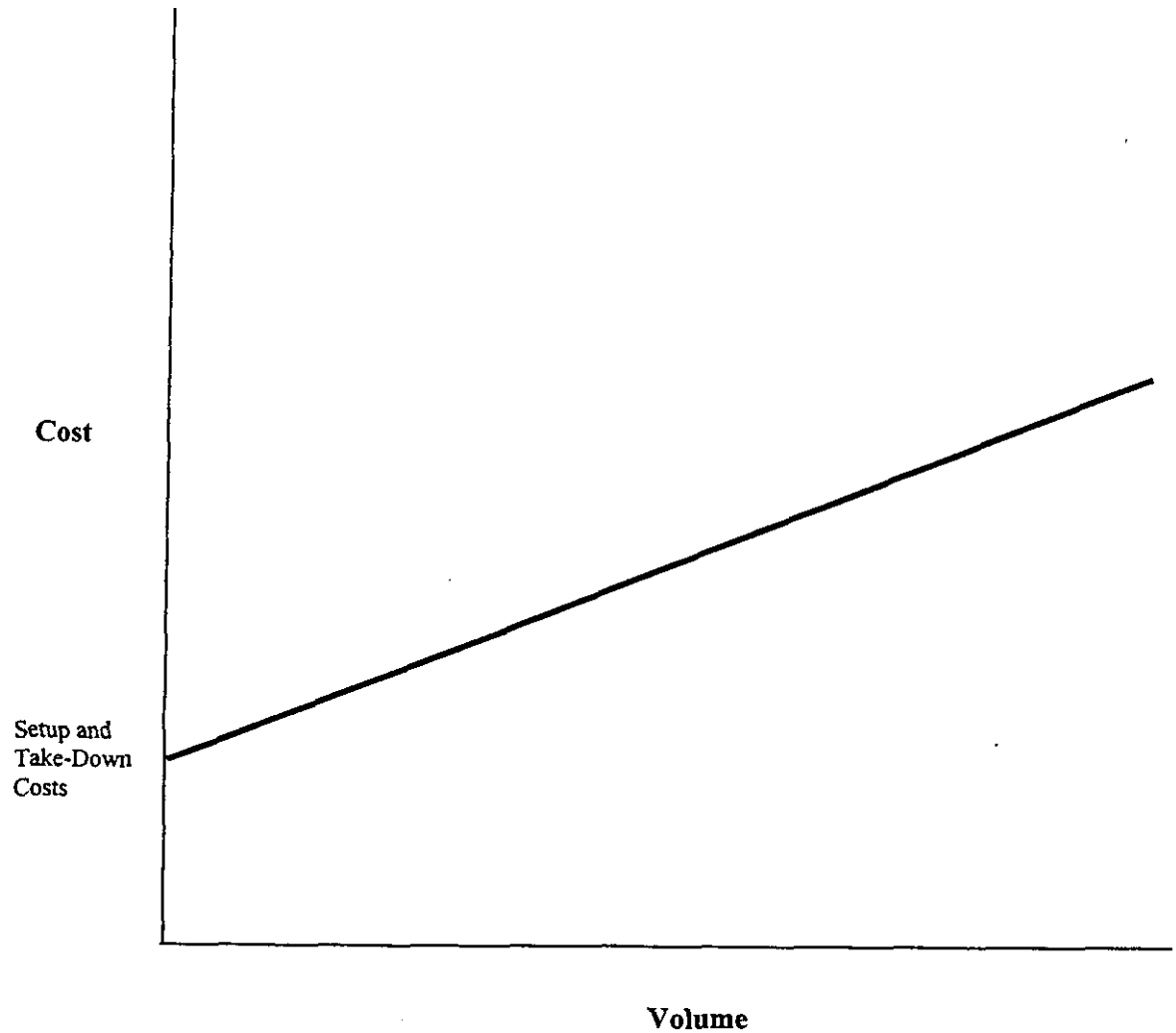
34. USPS-T-16, p. 51.

mail processing operations may very well experience *dis*economies of scale, manifested as volume variabilities in excess of 100 percent.

(1) Existence of Setup and Takedown Times

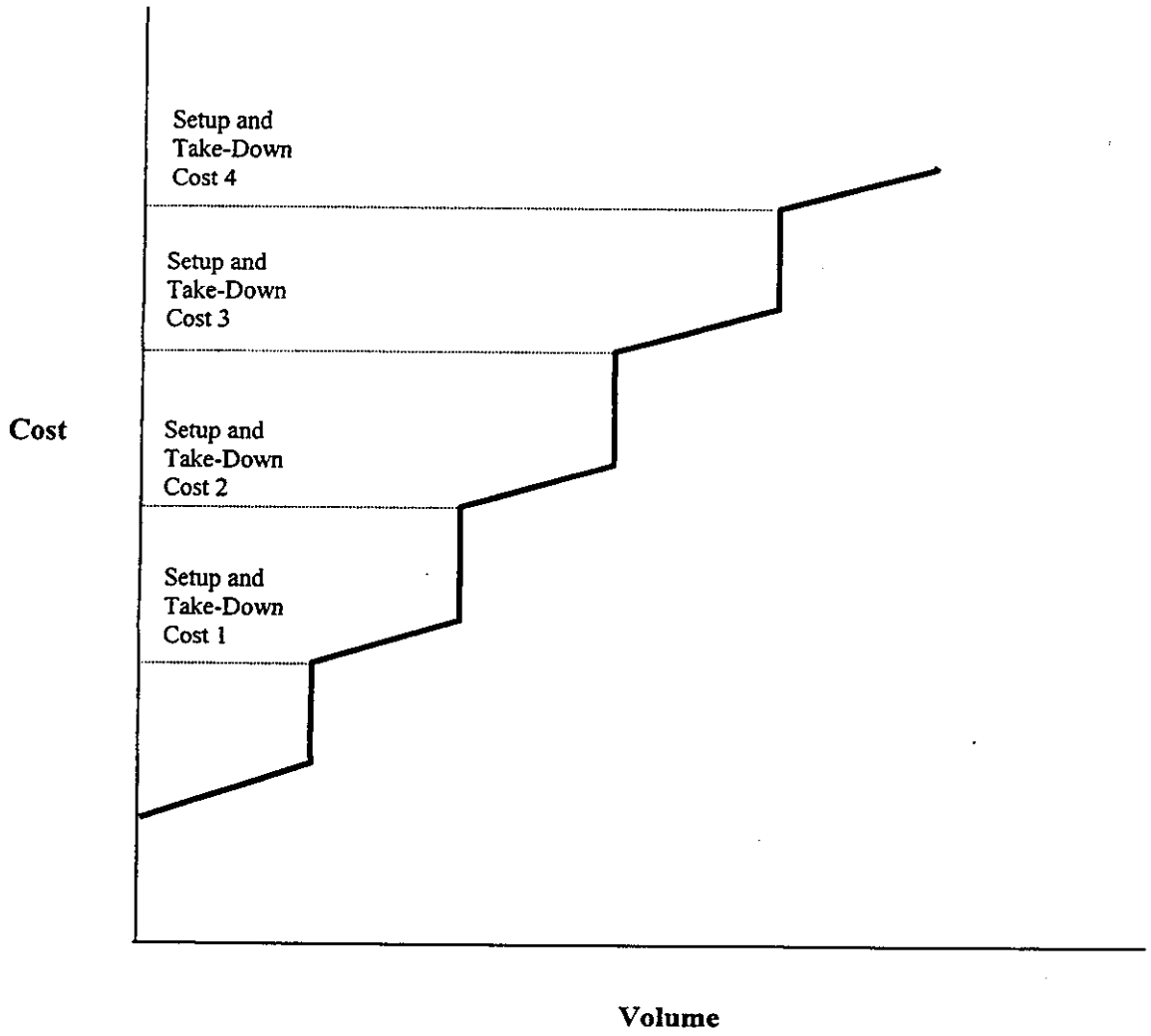
Mr. Degen argues that setup and takedown times for an operation represent a fixed cost that does not vary with the volume of mail processed. Over at least some range of volumes, Mr. Degen is almost certainly correct. For small increases in volume, these costs will remain fixed and with growth they will be amortized over ever larger volumes, giving the result that such operations will exhibit economies of scale. Figure 7 depicts the relationship between volume and cost in just such a situation.

Figure 7
Setup and Take-Down Times Over a Limited Range of Volumes



However, what Mr. Degen fails to recognize is that large enough increases in volume may require replication of a mail processing operation, with a corresponding replication of setup and takedown times. This point is illustrated most clearly when there are setup and takedown times associated with the operation of a piece of mail sorting equipment. At some point, growth in volume could necessitate the installation of a second machine, at which point the setup and takedown times could be expected to double. Replication of setup and takedown times in response to continuing growth in volume could create a situation in which costs increase in a stepwise fashion in direct proportion to volume. Such a situation is depicted in Figure 8.

Figure 8
Replication and Stepwise Increase of Setup and Take Down Times in Response to Volume Growth



In this situation, the economies of scale associated with the existence of setup and takedown times are limited to a narrow range of volume changes. At the end of this range, when it becomes necessary to step up to the next capacity level, the process encounters substantial *dis*economies of scale. For a large change in volume that spans a number of steps, costs should increase in direct proportion to the change in volume.

This point is by no means a theoretical one. One of the MODS pools which, according to Mr. Degen, had setup costs involved the operation of Flat Sorting Machines. Table 1 on page 9 above shows the average number of machines per site for the facilities in Dr. Bozzo's dataset. That table selects some of the more significant pieces of equipment from the much longer list shown in Appendix B. To pick one example, the average number of flat sorting machines per facility starts at 5.6 in 1993, and grows over the period covered by Dr. Bozzo's data to 11.3. In this case, therefore, we are much closer to the situation depicted in Figure 8 than that shown in Figure 7.

(2) Implicit Assumption that Incremental Volume Growth Occurs in the Shoulders of the Peak

Mr. Degen explains that gateway operations such as culling and canceling require peak-load staffing early in the day and late in the day to ensure that mail can flow quickly to the outgoing sorting operations; he also explains that at other times of the day, because of the uncertain arrival times of mail batches, these gateway operations can hold idle capacity to process mail.[35] He goes on to say, "Increases in

35. USPS-T-16, p. 37.

total collection volume . . . will not increase cancellation hours proportionately . . . -- some of the waiting time will simply be converted to processing."[36]

What Degen ignores is the possibility that growth in volume could occur during the peak periods that govern staffing levels in these operations, rather than in addition to the shoulders of the peak when extra capacity is available. There is no evidence to suggest that in fact, incremental volume growth would occur only in the shoulders of the peak. If all volumes grow proportionately -- including the peak period volume that sets staffing levels -- one would expect staffing levels to grow proportionately in response. Existence of these waiting times in gateway operations would give rise to economies of scale only in limited situations in which volume growth occurred in a very specific and highly favorable manner.

(3) The Need in Gateway Operations to "Get Mail Into Processing"

Mr. Degen describes a perceived urgency in upstream gateway operations to move mail quickly to downstream mail sortation operations.[37] This sense of urgency suggests that the combination of finite downstream throughput rates and finite processing windows necessitate early upstream staffing to guarantee that every possible minute of downstream processing time is fully utilized. Otherwise, there would be no reason for concern about the possible buildup of unprocessed mail in gateway operations. The need to make full use of downstream processing capacity implies that gateway staffing levels are in fact volume driven. In this case the volume in question, however, is the volume to be processed in downstream operations, and the issue is the

36. USPS-T-16, p. 37.
37. USPS-T-16, p. 37.

ability of those operations to handle that volume within the available processing window. This example illustrates not only the volume variability of gateway staffing levels, but also the interdependency of the different activities housed within a mail processing facility.

(4) Worker Pacing in Manual Operations

Mr. Degen claims that machine paced operations should exhibit higher variabilities than worker paced operations. He explains that in worker paced operations, "[i]ncreased mail volumes create pressure to sort faster in order to meet dispatch requirements."[38] While it is likely that workers under pressure will work harder, Mr. Degen oversimplifies the relationship between mail volume and the amount of pressure to which workers in manual operations are subject.

Both Mr. Degen and Ms. Kingsley identify a number of different situations in which the Postal Service resorts to manual processing. Manual processing may be the only type of sortation available at a facility for that mail stream. The Postal Service also resorts to manual sorting for pieces of mail with physical characteristics that do not lend themselves to mechanized processing.[39] In flats processing, some plants resort to manual processing when the available sorting equipment is being used to full capacity.[40] Particular batches of mail may also be sorted manually if they arrive too late in the

38. USPS-T-16, p. 41.
39. USPS-T-10, p. 13.
40. USPS-T-16, pp. 43-44.

processing window to accommodate the setup and takedown times associated with mechanized processing.[41]

The time pressure associated with these various situations are likely to vary dramatically. For example, late arriving mail could well put workers under enormous pressure, even if the volumes are relatively low. More generally, the amount of pressure workers operate under will reflect the relationship between the volume of mail to be processed, and the number of labor hours scheduled. This relationship is heavily influenced by supervisory personnel.

Mr. Degen's arguments regarding worker pacing suggest that he is taking an extremely short run view of volume variability. It is clearly the case, as many witnesses have testified, that mail volume varies randomly, and that supervisors set staffing levels to handle an expected workload. In such situations one can well imagine that there will be light days and heavy days, and that productivities in worker-paced operations might vary in response to these changes in workload. However, a sustained increase in workload is likely to lead to changes in staffing levels. It is up to supervisors to determine what those staffing levels will be, and I have seen no evidence to suggest that they would demand higher and higher productivities as mail volumes grow.

ALTERNATIVE CALCULATIONS OF VOLUME VARIABILITIES

(1) Overview

As I have explained, Dr. Bozzo's analysis is vulnerable to a number of potentially serious biases. Dr. Bozzo's analysis ignores serious issues of data quality for manual

41. USPS-T-16, p. 20.

operations. It also maintains the artificial assumption of proportionality of piece handlings with true volume. Perhaps most important, it ignores structural changes, at both the facility and the system levels, that undoubtedly alter the underlying efficiency of mail processing. Dr. Bozzo's failure to address these concerns renders his variability estimates unreliable.

In this section, I present alternative calculations that directly address each of the biases described. Concerns over data quality and over the proportionality assumption can be examined within Dr. Bozzo's MODS-level analysis. Indeed, my first two sets of calculations intentionally adopt and modify the MODS level setup in order to illustrate the effects of data errors and violations of the proportionality assumption, respectively, on Dr. Bozzo's estimated variabilities. Specifically, I explore the effects of aggregating up to the shapes level for letters, flats, and parcels, and adjust both MODS level and shapes level TPH variabilities for the elasticities of TPH with respect to volume. However, it is not possible using facility, MODS-level analysis to account for structural changes. Concerns about such structural changes in underlying technology and organizational design of the postal system can only be examined outside of Dr. Bozzo's setup -- which by its very nature ignores facility-wide and system-wide changes. Consequently, my third set of calculations presents new elasticity estimates using aggregate system-level volume and mail processing cost segment data.

All three sets of analyses demonstrate the sensitivity of Dr. Bozzo's estimates to a more serious treatment of the concerns raised by the Commission in R97-1. Moreover, all three find volume variabilities that are much closer to one hundred percent, and often in excess of that level.

(2) Aggregation by Shape Produces Higher Volume Variabilities for Parcels and Flats

As noted above, a careful look at the TPH series for Manual Parcels and SPBS reveals that data for the two are sometimes commingled. Because a significant fraction of the gross errors in Manual Parcels may be explained by the commingling of SPBS and Manual Parcel reporting, I combine these two MODS groups into a single Parcels group. TPH for the combined group equals the sum of the TPH for Manual Parcels and SPBS. Combining the two MODS groups in this way eliminates reporting discrepancies between them.

There are arguments quite apart from the commingling of reporting for aggregating MODS pools up to the shapes level. As I have discussed, manual and automated processing activities represent parallel and interdependent methods for handling the same mail stream. For this reason, it may be appropriate to view the set of activities for a specific shape as an integrated whole and to measure the volume variability of that integrated process. Hence, I also estimate shape and volume variability for letters and flats.

Details of my procedures for aggregating to the shapes level are contained in my workpapers. In general, this involves simply summing the hours and piece handlings used in the individual MODS level regressions. It was necessary, however, to distinguish between true zeros and missing values. In general, I treated a string of consecutive zeros at either the start or the end of the series for a site as true zeros, and zeros embedded in the middle of the series as missing values. A missing value for a component MODS pool would result in deletion of the entire observation from the shape

level sample. In constructing the new shapes level wage variables, I noticed that an unusually large number of LDC 13 wages were missing from the data, resulting in a considerable reduction in sample size. To minimize the effect of wages on sample selection, I used predicted postal wages when actual postal wages were missing.[42]

The final analysis samples consists of 4,807 observations for letters, 4,774 observations for flats, and 3,651 observations for parcels.

I estimate Dr. Bozzo's labor demand model using panel fixed effects estimation with the modified Baltagi and Li's generalized least squares procedure, to allow the regression disturbances to exhibit first-order serial correlation. Following Dr. Bozzo, I then evaluate volume variability at the sample mean. As Table 8 shows, the estimate of Parcels variability produced in this way is 0.750, with a standard error of 0.034. By contrast, Dr. Bozzo estimates a SPBS variability of 0.641 and a Manual Parcels variability of 0.522. The estimated variability for Parcels is about 29% higher than the average of the SPBS and Manual Parcel individual variabilities. This pattern is likely explained by the elimination of gross errors in data reporting across the two parcel sorting operations.

Table 8 also shows comparable results for the other two principal shapes: flats and letters. In the case of flats, I find results like those described above for parcels. Dr. Bozzo's analysis produces volume variabilities of 0.817 and 0.772 for FSM and manual flat sorting, respectively. Combining these two into a single composite flats group yields

42. Predicted wages are constructed from a set of ancillary regressions of actual wages on a complete set of facility and time dummies. The full regression outputs are included in Appendix E.

an estimate of volume variability of 0.857 -- higher than either of Dr. Bozzo's MODS pool estimates.

The picture with letters is somewhat different. Aggregation by shape produces a composite volume variability of 0.663, lower than any of the estimates for Dr. Bozzo's letter-based activities. As I have shown, however, in the case of letters there is an exceptionally high elasticity of piece handlings with respect to volume. Below I show that this high elasticity offsets the low elasticity of labor hours with respect to letter piece handlings, and produces a final estimate of volume variability for letters that is in excess of 100 percent.

Table 8

Estimated Volume Variabilities - Shapes Level

Shape	Variability	Std. Error	Sample Size	Adj R2	Rho
Letters	0.663	0.023	4807	0.997	0.650
Flats	0.857	0.022	4774	0.996	0.615
Parcels	0.750	0.034	3651	0.959	0.589

Notes and Sources:

1. Data from reg9398.xls, provided in USPS-LR-I-107.
2. The Letters shape includes OCR, LSM, BCS, and Manual letter sorting. Bozzo's variabilities for these MODS groups are 0.751, 0.955, 0.895, and 0.735, respectively.
3. The Flats shape includes FSM and Manual flats sorting. Bozzo's variabilities for these MODS groups are 0.817 and 0.772, respectively.
4. The Parcels shape includes SPBS and Manual parcels sorting. Bozzo's variabilities for these MODS groups are 0.641 and 0.522, respectively.
5. Appendix F presents the full set of labor demand estimates for the shapes-level regressions.

(3) Correcting Dr. Bozzo's Variabilities for TPH/FHP Elasticities

Both the MODS-level and the shapes-level analyses presented above show that THP/F grows disproportionately faster than FHP. These results imply that the elasticities of labor costs with respect to TPH/F systematically underestimate the true volume variability. In particular, when TPH/F grows 50 percent faster than FHP, a 10 percent increase in FHP results in a 15 percent increase in TPH. Consequently, to know how a one percent increase in FHP affects costs, it becomes necessary to adjust the THP elasticity by a factor of 1.50.

Formally, the Postal Service's distribution key method requires an estimate of the elasticity of labor costs with respect to volume. This elasticity can be decomposed as:

$$\frac{d\ln C}{d\ln FHP} = \frac{d\ln C}{d\ln TPH} x \frac{d\ln TPH}{d\ln FHP}$$

Dr. Bozzo's analysis provides an estimate of the first component. Under the proportionality assumption, which requires that the second component exactly equal

one, Dr. Bozzo's elasticity is equal to the true volume variability. However, my estimates demonstrate that the second component is in fact significantly greater than one, indicating a need to adjust Dr. Bozzo's variabilities.

Tables 9 and 10 present adjusted volume variabilities using both the MODS-level and the shapes level estimates of the elasticity of TPH with respect to FHP, respectively. Most of these corrected volume variabilities are well in excess of one, indicating the presence of diseconomies of scale. The sole exception is the Priority MODS pools, which, as I note above, is subject to an exceptional degree of reporting error.

Table 9

MODS-Level Estimates of the Elasticity of Labor Costs with Respect to First Handled Pieces

MODS Group	Bozzo's Variability of Costs w.r.t. TPH	MODS Level Variability of TPH w.r.t. FHP	Shapes Level Variability of TPH w.r.t. FHP	Volume Variability With MODS Level Correction	Volume Variability With Shapes Level Correction
OCR	0.751	1.597	2.062	1.199	1.549
LSM	0.954	1.069	2.062	1.020	1.967
BCS	0.895	2.091	2.062	1.871	1.845
Manual Letters	0.735	1.229	2.062	0.903	1.516
FSM	0.817	1.544	1.318	1.261	1.077
Manual Flats	0.772	1.010	1.318	0.780	1.017
Parcels[3]	0.750	1.795	1.795	1.346	1.346
Priority	0.522	1.010	1.013	0.527	0.529

Notes and Sources:

1. Volume variability is defined as :

$$\frac{\partial \ln C}{\partial \ln FHP} = \frac{\partial \ln C}{\partial \ln TPH} x \frac{\partial \ln TPH}{\partial \ln FHP}$$

2. Bozzo's variabilities taken from USPS-T-15, pp. 119-120.
3. For Parcels, the elasticity of costs with respect to (w.r.t.) TPH was estimated by combining the SPBS and Manual Parcels MODS groups, as described in the text of my report and presented in Table 8. The full set of coefficients used to construct this variability is presented in Appendices E and F.
4. The MODS-level variability of TPH w.r.t. FHP is taken from Table 6.
5. The Shapes-level variability of TPH w.r.t. FHP is taken from Table 7. Letter variability of TPH w.r.t. FHP applied to MODS groups OCR, LSM, BCS, and Manual Letters. Similarly, Flats variabilities applied to Manual Flats and FSM.

Table 10

Shapes - Level Estimates of the Elasticity of Labor Costs With Respect to First Handled Pieces

Shape	Variability of Costs w.r.t. TPH	Variability of TPH w.r.t. FHP	Volume Variability
Letters	0.663	2.062	1.367
Flats	0.857	1.318	1.130
Parcels	0.750	1.795	1.346
Priority	0.522	1.013	0.529

Notes and Sources:

1. Volume variability is defined as :

$$\frac{\partial \ln C}{\partial \ln FHP} = \frac{\partial \ln C}{\partial \ln TPH} x \frac{\partial \ln TPH}{\partial \ln FHP}$$

2. Shapes-level variabilities of costs w.r.t. TPH taken from Exhibit 9.
3. Shapes-level variabilities of TPH w.r.t. FHP is taken from Exhibit 11.

(4) Time Series Analysis of System-wide Mail Processing Costs

None of the alternative estimates of volume variability presented above reflects the full response of the Postal Service to changes in mail volume. Indeed, analyses based upon Dr. Bozzo's analytical framework cannot do so. To overcome this limitation and capture the effects of structural changes in the underlying technology and organizational design of the postal system, I analyze the effects of mail volume on work hours using aggregate, system-level time series data on volumes and mail processing costs. These aggregate data, by their very nature, automatically reflect net changes in productivity and efficiency from system-wide structural changes. They also circumvent concerns over both measurement error with piece handlings data at the facility level and the use of piece handlings as a proxy for true volume. Thus, the aggregate analysis is a conceptually superior alternative to the MODS-level analysis presented by Dr. Bozzo.

The analysis uses annual mail volume by class from 1981 to 1998. The classes include First Class Mail, Priority Mail, Express Mail, Periodicals, Standard (A), and Standard (B). The analysis also incorporates annual data on work sharing by class and on mail processing costs. I adjust for the effects of inflation using the GDP deflator. The volume and work sharing data are taken from LR-I-117. The mail processing costs data for cost segments 3.1 (Mail Processing Clerks and Handlers), 2.1 (Mail Processing Supervisors), and 11.2 (Mail Processing Operating Equipment Maintenance) are taken from the Postal Service's response to Interrogatory UPS/USPS-T11-7-17, Tr. 21/9351-52. My selection of an inflation index is guided by analysis of data on postal wages obtained from the U.S. Office of Personnel and Management's 1984-1994 Postal Service Employees and Payroll Report. The GDP deflator is from the Bureau of Commerce, and data on four other wage series I considered are taken from the Bureau of Labor Statistics. Finally, the analysis uses base year data from the In-Office Cost System ("IOCS") and work hours data from Dr. Bozzo's MODS data.

Due to sample size limitations, estimating effects of changes in volume on aggregate mail processing work hours requires consideration of three important data issues. The first issue arises in the adjustment of mail processing costs for the effects of inflation. In principle, this adjustment could be carried out using data on average postal wages. However, direct information on postal wages is available only for the years 1986-1995 and 1997. In the interest of preserving sample size, I investigated the relationship, during the more limited period for which postal wage data are available, between postal wages and more readily available inflation indices, including other wages series, the Consumer Price Index, and the GDP deflator. I find that the GDP

deflator tracks postal wages most closely.[43] Inflation adjusted costs, then, are computed as $\frac{Cost_t}{GDPDeflator_t}$.

The second issue arises from the fact that different classes of mail place different burdens on the mail processing system, and hence have different per piece costs. If sample size were not an issue, one could simply estimate separate coefficients for the individual effects on mail processing costs of volumes by class. However, this would require a six-fold increase in the number of parameters to be estimated -- too heavy a burden for the relatively small sample to bear. Consequently, it becomes necessary to find a way to weight the classes in a single composite measure of volume.

I aggregate volumes based upon the labor intensity of the different classes. The weighting scheme is derived from a combination of base year IOCS data and 1998 MODS data on labor hours. The IOCS data provide a breakdown of base year labor hours at the MODS pool level by class. This distribution, referred to as the transition matrix from MODS groups to subclasses, is shown in Appendix G. From Dr. Bozzo's dataset I obtain quarterly 1998 data on labor hours by MODS pool. Using the transition matrix, I first disaggregate base year MODS pool labor hours into classes, and then sum across MODS pools to derive overall labor hours by class. These figures are shown in Appendix H. Using these base year labor hours and base year volumes, I

43. The GDP deflator was chosen by comparing R2 across six different regression models which relate the log of postal wages to a constant and the log of one of the other wage or price series. The R2 from the regression with GDP deflator is 0.871. The other R2 are 0.418, 0.819, 0.792, 0.857, and 0.884 for each of the four wage series and the CPI, respectively. In addition, of all of these regressions, the GDP deflator regression had the coefficient estimate closest to one.

then construct my composite volume measure as follows: $V_t = \sum_j w_j V_{jt}$, where *j* indexes subclass and $w_j = \frac{HRS_{j,98}}{V_{j,98}}$. This weighting scheme implicitly gives relatively more weight to the more labor-intensive classes.

The aggregate mail processing cost equation, then, is given by:

$$\ln(\frac{Cost_t}{GDPDeflator_t}) = \alpha_0 + \alpha_1 \sum_j w_j V_{jt} + e_t$$

where *t* indexes time, *j* indexes the class, and e_t is the stochastic error term.

The final issue to be accounted for involves the work sharing in certain classes that reduces the effective volume of mail requiring processing. The volume data contain information on work sharing volumes. Again, if sample size were no issue, we would simply allow work share volumes to separately enter the cost equations. I incorporate the work share information into the mail processing cost equation as follows:

$$\ln(\frac{Cost_t}{GDPDeflator_t}) = \alpha + \alpha_1 \ln(\sum_j w_j (V_{jt} - \lambda V^*_{jt}) + e_t$$

where *t* indexes time, *j* indexes class, V_{jt} is the work share volume for class *j* in period *t*, and $w_j = \frac{L_{j,98}}{V_{j,98} - \lambda V^*_{j,98}}$. The parameter λ is the degree to which work sharing effectively reduces volume.

The parameter α_1 is the volume variability parameter. Estimation methodology depends upon the treatment of the work share parameter. To illustrate the role of this parameter, consider setting $\lambda = 0.80$. This would mean that work shared volume requires only a fifth of the mail processing effort that is required by non-work shared

volume. If λ is treated as a fixed parameter, the model can be estimated using ordinary least squares. Otherwise, all these parameters can be estimated using nonlinear least squares.

Table 11 presents the ordinary least squares estimates for three values of λ, 0.60, 0.70, and 0.80, and for three different definitions of mail processing labor costs. The leftmost column in the table focuses on mail processing clerk and mailhandler costs (cost segment 3.1), and adopts the narrowest definition of costs. The middle column adds labor costs associated with mail processing equipment maintenance (cost segment 11.2). The rightmost column broadens the cost definition further by adding the labor costs associated with supervision of mail processing (cost segment 2.1). The results strongly indicate that volume variabilities are greater than or equal to one. Estimates of volume variability range from a low of 98 percent to a high of 123 percent, indicating the presence of substantial *dis*economies of scale. In a number of instances, the difference from 100 percent is statistically significant.

Table 11

Aggregate Time Series Analysis, 1981-1998
Dependent Variable: ln(Costs/GDP Deflator)

Parameter	Work Share Parameter = 0.8		
	MP Clerks and Handlers	MP Clerks, Handlers, and Operating Equipment Maintenance	MP Clerks, Handlers, Supervisors, and Operating Equipment Maintenance
Constant	-9.796	-11.412	-11.461
	(1.468)	(1.424)	(1.305)
Volume Variability	1.135	1.224	1.230
	(0.078)	(0.076)	(0.070)
Adj R2	0.925	0.939	0.949
Parameter	**Work Share Parameter = 0.7**		
	MP Clerks and Handlers	MP Clerks, Handlers, and Operating Equipment Maintenance	MP Clerks, Handlers, Supervisors, and Operating Equipment Maintenance
Constant	-8.147	-9.650	-9.696
	(1.365)	(1.310)	(1.192)
Volume Variability	1.048	1.131	1.137
	(0.073)	(0.070)	(0.064)
Adj R2	0.924	0.939	0.950
Parameter	**Work Share Parameter = 0.6**		
	MP Clerks and Handlers	MP Clerks, Handlers, and Operating Equipment Maintenance	MP Clerks, Handlers, Supervisors, and Operating Equipment Maintenance
Constant	-6.836	-8.247	-8.290
	(1.288)	(1.227)	(1.112)
Volume Variability	0.979	1.057	1.063
	(0.069)	(0.065)	(0.059)
Adj R2	0.923	0.939	0.950

Notes and Sources:

1. Volume data from USPS-LR-I-117; accrued cost data from Postal Service response to UPS/USPS-T11-7-17, Tr. 21/9351-52; weights used to aggregate volumes constructed from the 1998 IOCS data provided in UPS-Sellick-W2, and reg9398.xls provided in USPS-LR-I-107; other data from 2000 U.S. *Statistical Abstract* and the Bureau of Labor Statistics.
2. Parameters and standard errors estimated using Ordinary Least Squares.

One pattern shown in Table 11 that is worth noting is the effect of the estimated volume variability of adding to the dependent variable the labor costs associated with the maintenance of mail processing equipment. In all cases, variability increases when these costs are added, implying that they have a higher volume variability than mail processing clerk and mailhandler costs. These results reemphasize the importance of considering capital costs in evaluating the response of mail processing costs to increases in volume. They also call into question Dr. Bozzo's argument that the capital intensity of mail processing is unaffected by growth in mail volume.

Clearly, the estimate of volume variability generated by this aggregate analysis depends upon what one uses for the workshared cost saving percentage. To provide a factual basis for this measure, I reestimated the model presented above, using nonlinear least squares and specifying the workshared cost saving percentage as a parameter. Table 12 presents results based upon the same definitions of cost depicted in Table 11. Estimated values for the workshared savings percentage range from .63 to .86, depending upon the cost definition used.

One point worth mentioning in connection with the results shown in Table 12 is that the estimated work share discount is higher for the narrower definition of costs -- based just on mailhandlers and clerks -- that for the broader definitions that include supervisory and equipment maintenance personnel. The result makes sense, since it is the handler's work that is being shared. Point estimates for volume variability are in all cases in excess of 100 percent, although in this more general model they are not statistically distinguishable from 100 percent.

Table 12

Nonlinear Aggregate Time Series Analysis, 1981-1998
Dependent Variable: ln(Costs/GDP Deflator)

Parameter	MP Clerks and Handlers	MP Clerks, Handlers, and Operating Equipment Maintenance	MP Clerks, Handlers, Supervisors, and Operating Equipment Maintenance
Constant	-10.892	-9.782	-8.711
	(5.736)	(5.733)	(5.293)
Volume Variability	1.193	1.138	1.085
	(0.303)	(0.303)	(0.279)
Work Share	0.855	0.708	0.632
	(0.256)	(0.350)	(0.383)
Adj R2	0.920	0.935	0.946

Notes and Sources:

1. Volume data from USPS-LR-I-117; accrued cost data from Postal Service Institutional response to UPS/USPS-T11-7-17, Tr. 21/9351-52; weights used to aggregate volumes constructed from the 1998 IOCS data provided in UPS-Selllck-WP2, and reg9398.xls provided in USPS-LR-I-107; other data from 2000 U.S. *Statistical Abstract* and the Bureau of Labor Statistics.
2. Parameters and standard errors estimated using Nonlinear Least Squares.

These results are derived from a model which, although highly simplified, responds fully to the concerns I have raised regarding both Dr. Bradley's R97-1 analysis and Dr. Bozzo's current analysis. This aggregate model is based upon an appropriate measure of mail volume. It encompasses the full range of actions taken by the Postal Service in response to changes in volume, and allows for the presence either of economies of scare or of diseconomies of scale at the activity, plant, and system levels. It presents results sharply at variance with those of Dr. Bozzo, and supports the Commission's historically-held view that mail processing labor costs are 100 percent volume variable. It suggests that at the system level there are, if anything, diseconomies of scale.

WHAT SHOULD A STUDY OF MAIL PROCESSING COST VARIABILITY LOOK LIKE?

On two occasions now I have been highly critical of the studies of mail processing cost variability introduced by witnesses testifying on behalf of the Postal Service. Although I believe firmly that these criticisms are warranted, I recognize the Commission's need for reliable information on this important subject. Accordingly, I end my testimony with some comments about how an appropriately designed study of mail processing cost variability should be structured.

(1) Only Plant or System Level Analysis Can Fully Capture the Interactions Between Activities.

As I have argued throughout my testimony and demonstrated through both empirical analyses and citations to the testimony of Postal Service operational witnesses, there are important interactions between the activities present in a mail processing plant. In most cases, for a given mail stream manual and automated

processing activities operate in parallel and interact in complex ways. In many instances, the same mail passes sequentially through multiple MODS activities. This is especially true if one considers not just the direct activities that are the subjects of Dr. Bozzo's analysis, but also the allied activities. Staff can be reassigned from one activity to another. Congestion at a facility can influence the processing of all of the different mail streams.

For all of these reasons, I believe that it is inappropriate to attempt to estimate mail processing cost variabilities through analyses conducted at the MODS pool level. In principle, given detailed enough models, one ought to be able to arrive at the correct result. As a practical matter, however, I doubt that such richly specified models will be achievable in the foreseeable future. It is clear from Dr. Bozzo's testimony that he conducted an extensive review of Postal Service databases in an effort to locate information suitable for use in his analysis. This huge effort resulted in the inclusion of a few additional variables in his analysis, but did not fundamentally alter his analysis or conclusions. I do not believe that, with the information that is realistically available, it is or will be possible to capture in a MODS pool analysis the effects of the rich set of interactions that occur within a mail processing plant.

An appropriate study of mail processing cost variability should focus on system-level analyses, or at minimum on plant-level analyses. If analysis is conducted at the plant level, it should account explicitly for the effects of changes in the network that alter the number, configuration or operating characteristics of plants.

(2) Capital Costs Play an Integral Role in the Postal Service's Response to Volume Growth.

It is absolutely clear that mechanization and automation are integral elements of the response of the Postal Service to growth in mail volume. As automation programs progress, the focus of these programs necessarily must switch from the substitution of capital for labor to providing enough capital and enough processing capacity to accommodate growth in volume. These fundamental facts imply that no analysis of mail processing cost variability can be complete without a full and adequate treatment of capital costs.

A full treatment of capital costs in this context would have to account for all aspects of the Postal Service's automation programs. These include the capital expenditures associated with the expansion of automated processing, changes in the mix of activities that result from the installation and upgrading of mail processing equipment, and the ongoing costs associated with the upkeep of that equipment.

(3) Growth in Delivery Points Must Be Considered a Part of the Growth In Volume.

A number of Postal Service witnesses have drawn distinctions between growth in volume and growth in "delivery points," or addresses to which mail might be delivered. The former, they argue, represents a "true" increase in volume whose effects should be reflected in rates. The latter, they assert, merely represents a change in network structure, and has no implications for ratemaking. This argument reappears in various forms in the testimony of a number of different witnesses.

Ms. Kingsley, for example, draws this distinction in her discussion of changes in staffing levels: "Delivery volume growth can be due to more pieces per delivery, or

more delivery points. If it is a pure volume increase without any changes in mail composition or delivery area it is relatively easy to handle."[44]

In Dr. Bozzo's testimony, the distinction is drawn once again. His econometric models include as explanatory variables both the number of piece handlings and the number of delivery points within each plant's service territory. He strongly rejects the idea that volume and delivery points have anything to do with one another: "Volume and network characteristics interact in complicated ways, but volume does not cause network characteristics. Recipients (addresses) must exist before there is any need to generate a mail piece."[45]

There is ample evidence in the record both in the testimony of operational witnesses and in the results of econometric analyses to suggest that volume growth resulting from an increase in mail volume per delivery point will have an effect on processing costs that is different from that of volume growth arising from an increase in the number of delivery points. That such differences should exist is not surprising. Similar cost structures can be found in other industries. They indicate that there are costs associated with connecting a new point to the network that do not vary directly with the volume generated by that point. A situation in which it costs less to expand volume within a fixed network than to expand the size of the network has been described as one characterized by "economies of density."

Postal Service witnesses have argued that increases in cost associated with growth in the number of addresses have no relevance to ratemaking. They argue, in

44. USPS-T-10, p. 30.

45. USPS-T-15, pp. 47-48.

effect, that the only costs that need to be considered are the costs associated with increases in pieces per delivery point. This argument might have merit in a situation in which mailers paid a two-part tariff consisting of a fixed charge for connecting to the network, and a variable charge associated with the number and mix of pieces mailed. But postal rates do not work that way, and that fact raises questions about how the costs associated with growth in the number of delivery points should be recovered.

Conceptually, one can divide growth in the volume of mail handled by the Postal Service into two components, one having to do with growth in the number of delivery points and the other having to do with increases in the number of mail pieces per delivery point. The former component may represent a significant fraction of the volume growth experienced by the Postal Service. Population is growing, new businesses are being formed, the economy is expanding, and the number of addresses is increasing. As Ms. Kingsley, Mr. Degen, and Dr. Bozzo have testified, this component of volume growth affects the organization and the costs of mail processing operations.[46] It is costly to accommodate.

Increases in the *density* of deliveries, in contrast, will be much easier and less costly to accommodate. The volume growth experienced by the Postal Service will consist of a mixture of this high cost and low cost growth in volume. For this reason, Mr. Degen's marginal mail piece will be associated with changes both in network size and in network density.[47] To ignore the clear association between the size of the

46. USPS-T-10, pp. 30-35.

47. USPS-T-16, pp. 15-17.

network and the volume of mail delivered, as Postal Service witnesses have urged, would be to ignore significant elements of cost associated with volume growth.

(4) Analyses of Mail Processing Costs Require an Appropriate Cost Driver.

We have yet to identify an appropriate driver for an empirical analyses of mail processing costs. Piece handlings, the measure that has featured prominently in Postal Service testimony in two rate cases now, has a questionable and variable relationship to the true volume of mail being processed at a plant. First handling pieces, although appropriate from a conceptual standpoint, is subject to serious measurement problems. No other attractive candidates have surfaced.

I do not believe that progress will be made in this area until an appropriate cost driver can be identified. Although I do not yet know what that cost driver might be, I do know some of the properties it must have. First, it must be something that can be measured with some precision and reliability. Second, if it is to be able to support plant-level analyses, it should measure in some meaningful way the volume of mail coming into the plant. These two requirements to some extent conflict with one another. Piece handlings can be measured with precision, at least for mechanized operations. However, they are internal process measures, and not measures of the amount of mail flowing in from the outside world. Third and most obviously, the cost driver has to relate in a meaningful way to the ability of the mail stream to generate cost. The weight of the incoming mail stream, which apparently meets the first and second criteria, fails on this third.

I do not know yet what the right answer is in this context, but I am confident that little progress will be made until a good answer is found.

Appendix A

Kevin Neels — Vice President

Ph.D.	Cornell University
A.B.	Cornell University

Kevin Neels has over twenty years of economic research and consulting experience. He has worked on behalf of numerous public and private sector clients in a wide range of industries. A skilled econometrician, he specializes in the use of quantitative techniques to resolve practical business, legal and regulatory problems. His extensive practical experience in the use of economic analysis to inform business decision making and win the support of legislative, legal and regulatory authorities has taught him how to effectively communicate analytical results in laymen's terms.

Dr. Neels has offered expert testimony on a number of occasions, either in the form of an expert report, in deposition or orally. He has also supported leading academic expert witnesses. Dr. Neels has played a key role in legal and regulatory proceedings for which the financial stakes have often run into tens or hundreds of millions of dollars. His work in support of counsel has touched all phases of the legal process, including discovery, development of theory, preparation of expert testimony, examination of opposing witnesses, preparation of trial exhibits and development of cross-examination strategy.

A frequent focus of Dr. Neels' work has been estimation of economic damages. He directed the team of economists working for the Plaintiff in the trial that resulted in the largest damage judgment ever awarded in a patent infringement lawsuit. On many occasions he has developed econometric models to support economic damage claims and testimony in antitrust litigation. He has also frequently been responsible for review and analysis of damage estimates put into evidence by opposing experts and for development of strategies for refuting these claims.

Dr. Neels has extensive experience in the areas of antitrust economics and damage estimation. He has been designated as an expert witness and has offered deposition testimony in a number of antitrust disputes. His work has addressed issues of both geographic and product market definition, as well measurement of antitrust damages. His work in support of clients involved in antitrust litigation has touched all phases of the process, from earliest discovery through closing arguments at trial.

Dr. Neels possesses particular expertise in the analysis of spatial economic relationships. His work has addressed questions of geographic market definition, intraurban and interurban travel behavior, relationships between freight transportation costs and product prices, determinants of location decisions and relationships among spatially differentiated products. His work has assisted clients in diverse sections of both the passenger and freight transportation industries.

Among the projects Dr. Neels has successfully concluded are:

- For a group of automobile dealers he conducted an econometric analysis to quantify the extent to which these dealers had suffered economic injury as a

result of a scheme in which executives of the auto manufacturer accepted bribes from a subset of dealers in exchange for providing them with extra allotments of highly profitable car models. The settlement of this litigation awarded a payment of several hundred million dollars to the non-bribe paying dealers.

- For an express package delivery carrier intervening in a rate case before the U.S. Postal Rate Commission he conducted a critical review of econometric studies of cost variability introduced into evidence by a witness testifying on behalf of the U.S. Postal Service. He identified a number of serious conceptual and methodological flaws in this analysis, and demonstrated that the substantive conclusions of the analysis were sensitive to relatively minor change in its design. On the basis of his testimony the Commission rejected the arguments of the Postal Service in the Commission's final ruling.

- For a major international air carrier accused of monopoly leveraging and attempted monopolization of a key market he prepared a report analyzing the carrier's use of corporate discounts and travel agent override commissions to help rebut arguments that these agreements constituted exclusive dealings.

- He played a major role in the preparation of expert testimony on behalf of a group of major domestic oil companies accused of conspiring to depress the prices paid to producers of a major input to tertiary oil recovery projects. This testimony focused on an examination of purchase contracts involving the defendants to establish market prices for the input in question over the alleged damage period.

- For the International Air Transport Association he conducted an analysis and critique of a proposed change in the structure of air traffic control user charges levied on foreign carriers entering the U.S. and overflying its territory. He pointed out a number of serious flaws in the empirical analysis that formed the basis for the new system of charges. Implementation of the new charges was halted by a federal judge.

- For a manufacturer of class III medical devices he conducted a series of statistical analyses of turnover in the population of patients using a number of the company's key products. This analysis produced a profile of how patients clinical situation and needs evolved over time. These results provided the basis for a redirection of the company's product development strategy.

- Working for plaintiffs in an antitrust lawsuit involving the petroleum industry, he prepared an expert report criticizing analyses and testimony of defendants' experts. This report reviewed flaws in defendants' geographic market definition

and rebutted criticisms made by defendant experts of plaintiffs' damage calculations.

- In support of a key economic witness in a hearing regarding refined petroleum product pipeline rates before the Federal Energy Regulatory Commission, he conducted an analysis the relationship between product prices in the different geographic areas linked by the pipeline system. He also examined alternative transportation modes and concentration in the pipeline's origin markets.

- For a major international oil company, he offered advice on econometric issues raised by an empirical study of the determinants of fair market value for a specific grade of crude oil.

- For the U.S. Department of Energy, he conducted an extensive investigation of the technological, institutional and economic factors influencing the demand for residential heating fuels.

- For a Gas Research Institute study of natural gas usage in the steel industry, he provided consultation on statistical issues and worked closely with a team of analysts examining the economics of fuel substitution.

- For a small package express company, he conducted a detailed analysis of the economic incentives created by alternative regulatory frameworks. This effort focused on the effects of proposed regulatory changes on entry by new firms, on the competitive structure of the market and on the potential for cross-subsidy by multi-product firms with diverse offerings.

- He played a critical role in a project for the Air Transport Association (ATA) of the United States to evaluate proposals for reforming the nation's air traffic control (ATC) system and to develop an effective financial and organizational structure for a reformed ATC. The plan, developed under extremely tight deadlines, required an assessment of ATC technological capabilities, estimation of the cost effects of ATC on the airline industry, an economic analysis of current and proposed ATC organizational forms and detailed financial assessment of proposed ATC entities. Dr. Neels presented his analysis and proposal to airline chief executive officers at a meeting of the ATA board.

- Working of behalf of a major air carrier in an antitrust case involving allegations of predatory pricing, he worked directly with the lead litigator to develop a strategy to guide the discovery portion of the case. Subsequently, he conducted a variety of econometric analyses measuring the extent to which plaintiffs were harmed by the alleged predation.

KEVIN NEELS

- For a consortium of major U.S. air carriers accused of engaging in collusion and price fixing, he directed a major economic analysis of industry pricing strategy and dynamics. Drawing upon detailed data on daily fare changes, he prepared testimony and exhibits demonstrating the difficulty of engaging in coordinated pricing behavior.

- For a major U.S. air carrier, he conducted an extensive empirical investigation of the responses of travel agents to carriers' incentive and override programs. Using the results of this investigation, he evaluated his client's sales force management and travel agent incentive strategies to identify specific ways in which redesign and or retargeting could increase their net revenue yields.

- He assisted in the preparation of statistical exhibits and an expert affidavit for submission by a major U.S. carrier in a rulemaking proceeding regarding airline computerized reservation systems conducted by the U.S. Department of Transportation.

- He provided expert deposition testimony on geographic market definition in an antitrust lawsuit between a regional medical center and a physician-owned health clinic. To support his opinions he analyzed the structure of competition between alternative hospitals within the area and conducted an empirical analysis of patient decisions regarding choice of hospital for the service in question.

- For a biotechnology company involved in a trade secret misappropriation dispute with a competitor, he offered expert deposition testimony on potential fields of application for the technology in question and on the factors that influenced customer decisions to incorporate the new technology in their products. As part of this case he also conducted an empirical investigation in the role that technology licensing deals play in the financing of biotechnology start-up companies.

- To support expert testimony in an antitrust case between two major U.S. air carriers he developed and estimated a set of statistical models for estimating the effects of CRS display bias on the booking patterns and revenues of the affected airlines. As part of this effort he conducted an extensive analysis of the histories of the carriers in questions and of the development of computerized reservation systems as the primary channel of distribution for airline tickets. He also prepared damage estimates, assisted in the deposition of opposing expert witness, prepared trial exhibits and advised counsel on cross-examination strategy during the course of the trial.

- He directed the team of economists responsible for conduct of the damages study for plaintiff in a major patent infringement lawsuit in the consumer products industry. His work included development of econometric models to forecast product sales in eight major world markets, analysis of the effects of incremental changes in sales volumes on company profits, review of historical pricing strategies and calculation of economic damages for a wide range of "but-for" pricing and product introduction strategies. He and his team also played a key role in the analysis of the case put forth by the opposing side and in the development of cross-examination strategies for opposing expert witnesses. He was designated as an expert witness in this matter, but was not called upon to testify.

- For the public authority responsible for the operation of one of the largest international gateway airports in the country, he conducted a comprehensive review of sources of information on air cargo movements. Based upon the results of this review, he worked with authority staff to devise a strategy for monitoring trends in shipments by ultimate origin and destination, commodity, carrier and type of service, and for factoring this information into an improved process for planning and executing air cargo facility improvements.

- Working under extreme deadline pressure for a European pharmaceutical company, he estimated savings in total medical costs from pharmacological therapy for chronic occlusive arterial disease in order to provide input to a key regulatory dossier. Results were subsequently published in a peer-reviewed journal.

- To support the development of an airport system plan for a major metropolitan area, he prepared long-range activity forecasts for air carriers, regional airlines and general aviation.

- For the developer of a medical device-based pain management therapy, he conducted a cost-effectiveness analysis for internal use. He built upon this work to develop a reimbursement and marketing strategy for the product.

- For the top management of an emerging health care company, he prepared an analysis and briefing to review the market implications of health care reform and the strategies adopted by competing firms in response.

- For a regional air carrier accused of engaging in predatory pricing, he assisted counsel in defining the relevant product and geographic markets and in developing estimates of the short-run marginal costs of serving those markets. He also prepared evidence on the ease of entry and on the likely behavior and strategies of potential entrants.

- For the operator of a system of outpatient medical clinics, he conducted an analysis of the economic incentives created by investments by referring physicians. His conclusions were summarized in a written report, along with discussion of their implications for policy regarding regulation of such investments by the federal government.

- For a major manufacturer contemplating litigation over an alleged theft of trade secrets, he developed a system of economic forecasting models to calculate the effects of the theft of sales of the company's products in a number of major international markets. Results of this confidential investigation played a key role in the company's subsequent decision to seek redress through the courts.

- For a group of physicians involved in a health insurance-related private antitrust lawsuit he conducted a critical review and analysis of damage models prepared by opposing experts. His findings provided the basis for expert testimony by a leading university-based economist. In addition, he provided assistance to counsel in the deposition of opposing economic experts.

- For the plaintiff in an antitrust suit involving an important line of biotechnology products, he conducted an analysis of therapeutic substitution possibilities to support development of testimony regarding product market definition.

- As leader of a project funded jointly by the Ford Foundation, the U.S. Department of Housing and Urban Development and a consortium of local corporations, he directed a year-long study by the Rand Corporation of strategies for privatizing municipal services in Saint Paul, Minnesota. A major component of this project was a detailed analysis of the incentives created by different financing mechanisms, organizational structures and personnel management systems. Findings of the study were published in a major report entitled *The Entrepreneurial City*.

- For the developer of a new cardiac diagnostic imaging agent, he used meta-analysis and receiver operating characteristic curve techniques to measure the accuracy of procedures using the agent relative to competing diagnostic techniques.

- For an arm of the National Academy of Sciences, he conducted an investigation of the innovation process in medical technology and analyzed how that process has been effected over time by changes in the institutional and economic environment.

- Working under a federally funded research grant, he served as a key staff member of a Rand Corporation study of the equity implications of substituting user charges for tax funding of public services.
- For the developer of a new orphan drug, he conducted a cost-benefit analysis, a review of political and legislative trends and a hedonic analysis of existing orphan drug prices to support development of a defensible pricing strategy.
- For a medical device company, he prepared a payor education brochure describing the results of a cost-effectiveness study of a new therapy, which allows payors to calculate the savings they could realize by granting coverage of the therapy.

Before returning to Charles River Associates to lead our Transportation Practice, Dr. Neels held a variety of responsible positions within the research and consulting industry. He was a vice president at PHB Hagler Bailly, Inc., and the vice president for Health Economics and managing director of the Cambridge office of Quintiles Inc., where he directed a team of economists serving a worldwide clientele of pharmaceutical and biotechnology, and medical device companies. Previously, he was vice president in charge of the pharmaceutical consulting practice at Charles River Associates. He has also served on the research staffs of the Rand Corporation, the Urban Institute and Abt Associates.

PROFESSIONAL AFFILIATIONS

American Economic Association

American Law and Economics Association

National Association of Business Economists

National Health Lawyers Association

International Health Economics Association

Drug Information Association

KEVIN NEELS

PUBLICATIONS AND TESTIMONY

Articles

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KEVIN NEELS

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Appendix B

Multi-Machine Installations and Changes in Technology Over Time

Equipment Description	PCN	1993	1994	1995	1996	1997	1998
Dockboard/Dockramp, Portable	230000	7.822	7.521	7.619	7.859	3.707	4.316
Platform Elevator/Lift, Portable	230010	9.240	9.406	9.537	9.540	8.572	8.565
Wheel Raiser	230020	1.000	1.333	1.000	1.000	1.000	1.000
Culling Machine	400000	1.436	1.381	1.398	1.418	1.487	1.454
Dual Pass Rough Cull System (DPRCS)	400010	1.304	1.333	1.333	1.333	1.313	1.286
Cancelling Machine, M-36	401000	5.840	5.478	5.850	5.450	5.000	3.600
Cancelling Machine, Mark II	401010	6.679	6.627	6.186	5.912	5.699	5.222
Cancelling/Facing Machine	401020	5.588	5.945	4.487	4.529	4.581	5.976
Cancelling Machine	401030	3.393	3.371	3.303	3.166	3.000	2.954
Canceller Flat	401040	1.821	1.807	1.816	1.824	1.585	1.600
Modification, Mark II Control	401094	1.000	1.000	1.000	1.000	1.000	1.000
Diverter Edger Feeder Attachment	402000	2.754	2.724	2.579	2.545	3.000	2.875
Edger Feeder	402010	6.416	6.313	5.785	5.556	5.220	4.696
Edger Stacker	402020	1.606	1.588	1.606	1.516	1.536	1.500
Inclined Feeder Assembly	402030	7.207	7.022	6.816	6.605	5.385	4.243
Stacker Unit	402040	1.680	1.640	1.717	1.673	2.071	2.036
Vibrator Hopper Assembly	402050	4.000	4.000	1.833	1.571	1.429	1.429
Conveyor	420000	17.303	18.260	19.153	20.058	16.242	16.285
Conveyor, Extendible	420010	3.034	3.066	2.906	2.939	2.522	2.483
Conveyor, Tractor	420030	2.333	2.333	1.833	1.857	1.857	1.875
Dumper, Hamper	420050	5.057	5.336	5.975	6.379	6.565	6.809
Rack, Tray Storage	421000	7.077	6.814	6.340	6.451	3.129	3.133
Strapping Machine, Non-Metallic	422000	9.259	9.467	9.397	9.498	8.238	8.003
Strapping System	422010	4.010	5.004	5.263	5.611	5.498	5.456
Tying Machine	422020	4.962	4.778	5.480	5.357	6.333	5.885
Tractor, Attachments & Accessories	423000	3.034	2.967	4.353	4.179	2.029	2.054
Tractor, Industrial & Farm Type	423010	1.133	1.121	1.121	1.088	1.056	1.077
Tractor, Tow/Tug/Warehouse	423020	9.945	10.255	11.005	11.475	11.435	11.896
Tractor, W/Auto Guidance System	423030	2.444	2.444	2.444	2.750	2.417	2.200
Truck, Fork Lift	423040	5.828	5.943	6.045	6.318	7.174	8.344
Truck, Hand Lift/Pallet	423050	4.436	4.617	5.196	5.576	6.159	6.844
Truck, Lift Specialized System	423060	1.877	1.729	1.773	1.974	2.095	2.247
Carrier, Cargo & Materials	440000	3.267	4.529	4.294	4.235	3.556	3.286
Carrier, Personnel	440010	3.906	3.853	4.200	4.278	3.781	3.667
Scooter	440020	1.364	1.364	1.222	1.222	2.000	2.600
Label Printing System	441000	2.667	4.107	4.277	4.281	3.847	3.656
Printer, Address Label	441010	4.162	4.415	4.566	4.383	2.375	2.133
Dispenser, Label	441020	3.304	3.120	2.354	2.195	1.415	1.338
Feeder, Label Printer	441030	1.333	1.333	1.600	1.600	1.600	1.600
Dispenser, Tape	442000	1.000	1.000	1.000	1.000	1.000	1.000
Rewrap Or Patch-Up Equipment	442010	1.944	1.923	1.905	1.907	1.825	1.693
Scale, Floor Or Platform	443000	4.613	4.730	4.763	4.795	3.276	3.375
Scale, Remote Console/Indicator	443010	2.196	2.185	2.339	2.242	2.192	2.111
Envelope Stuffer / Sealer System	444000	1.125	1.100	1.100	1.100	1.111	1.125
Bulk Conveyor	900000	2.407	2.492	2.366	2.419	2.397	2.449
Fixed Mech Memory Cont Sys	900010	2.286	2.125	3.444	3.444	2.111	2.111
Loose Mail Conveyor System	900020	1.848	1.857	2.022	1.891	1.776	1.784
Mail Preparation System	900030	1.521	1.566	1.615	1.759	2.145	1.982
Monorail Sorting System	900035	3.158	3.050	3.158	3.333	3.294	1.857
Multibelt Sorting System	900040	1.000	1.000	1.000	1.000	1.000	1.000
Multi-Slide	900050	1.396	1.396	1.435	1.476	1.487	1.500
Pallet Unloader	900060	2.263	2.426	2.571	2.723	2.681	2.862
PP Distribution Ring	900070	1.273	1.273	1.273	1.300	1.222	1.286
Tray Transport System	900080	2.468	2.632	2.604	2.725	2.539	2.653
Letter Sorting Machine, Multi Pos	910000	7.012	7.727	7.698	7.484	5.284	3.603
Letter Sorting Machine, Single Pos	910010	2.900	4.275	4.556	4.581	2.938	5.207
LSM Tray Conveyor System	910020	1.611	1.526	1.524	1.524	1.444	1.533

Appendix B

Equipment Description	PCN	1993	1994	1995	1996	1997	1998
LSM - Zip Mail Translator	910030	2.325	2.325	2.260	1.986	1.783	2.481
LSM - Electronic Sort Processor	910034	1.935	1.987	2.000	1.881	1.764	1.640
LSM - Expanded Zip Retrofit	910091	2.273	3.217	3.364	1.738	1.469	1.366
LSM - EZR Maintenance Terminal	910092	1.175	1.175	1.190	1.190	1.167	1.000
LSM Misc Modification Cost	910093	2.417	2.417	2.455	2.455	1.400	1.444
LSM - Vacuum System	910094	1.815	1.841	1.855	1.717	1.478	1.371
Flat Sorter Machine	920000	5.631	8.614	9.546	9.621	9.693	11.329
Flat Sorter Bin Unit	920010	1.667	1.667	1.667	1.667	N/A	N/A
Flat Sorter Cull Unit	920020	1.400	1.208	1.167	1.167	1.000	N/A
Flat Sorter Extractor Unit	920030	2.333	2.333	2.333	2.333	2.500	2.500
Flat Sorter Feed Unit	920040	1.867	1.867	1.793	1.821	1.727	1.619
Parcel Sorting Machine	930000	3.714	2.640	1.463	1.576	1.638	1.932
Small Parcel/Bundle Sorter System	930040	4.016	4.081	3.922	4.078	5.000	5.576
Small Parcel/Roll Sorter System	930050	1.200	1.167	1.222	1.364	1.333	1.313
Sack Sorting Machine	940000	2.500	2.771	2.378	2.467	2.568	2.674
Sack Sort Mach Modification	940099	1.600	1.600	1.250	1.250	1.250	1.250
Bar Code Reader	950000	15.780	19.339	18.490	17.847	9.716	9.648
Small Bar Code Sorter (SBCS)	950010	7.323	7.411	7.400	7.885	9.878	17.029
Delivery Bar Code Sorters (DBCS)	950020	6.743	14.964	20.015	24.773	25.261	26.621
Reader, Optical Character	960000	2.950	3.440	3.574	3.352	4.000	4.638
Reader, Optical Character (OCR/CS)	960010	5.715	6.462	7.031	8.048	9.797	18.613
Remote Bar Coding Image Process Sys	960020	1.000	1.087	1.103	1.123	1.845	2.665
BMC Container Loader/Unloader	970000	3.714	3.714	2.667	8.800	4.464	2.676
Loader/Unloader Modifcation	970009	1.000	1.000	1.000	1.000	1.000	N/A
BMC Inbound-Outbound Tow Conveyor	970010	4.000	4.000	3.000	3.000	3.000	3.000
BMC Parcel Sorting Induction Unit	970020	3.667	3.667	1.000	1.000	1.000	1.000
BMC Parcel Sorting Machine	970022	4.000	24.000	1.000	1.000	1.000	1.333
BMC Parcel Sorting Mach Mod Cost	970029	4.000	4.000	N/A	N/A	N/A	N/A
BMC Process Control System	970030	2.500	2.714	2.000	1.714	1.500	2.875
BMC Sack Shakeout Machine	970040	3.000	3.000	N/A	N/A	N/A	N/A
BMC Sack Sorter And Loader	970050	10.750	10.750	1.500	1.500	1.750	2.000
BMC Towveyor - Internal Tow Conv	970060	2.333	2.667	1.000	1.000	1.000	1.000
BMC Towveyor - Wearbar Lubricator	970062	1.000	1.000	N/A	N/A	N/A	N/A
Install Cost, Non-Fixed Mechanization	999998	2.181	2.181	2.174	2.202	2.180	2.045
Installation Cost Fixed Mechanization	999999	1.149	1.149	1.071	1.075	1.190	1.507

Source: Data from MPE93.txt-MPE98.txt in USPS-LR-I-244.

Appendix C

MODS Group OCR

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	0.725	1.292
	(0.053)	(0.016)
TPH2	-0.005	-0.027
	(0.003)	(0.001)
DPT	0.266	
	(0.022)	
T7	-0.065	
	(0.022)	
T8	-0.123	
	(0.032)	
T9	-0.100	
	(0.038)	
T10	-0.085	
	(0.041)	
T11	-0.134	
	(0.042)	
T12	-0.181	
	(0.044)	
T13	-0.163	
	(0.044)	
T14	-0.154	
	(0.045)	
T15	-0.190	
	(0.045)	
T16	-0.244	
	(0.045)	
T17	-0.234	
	(0.045)	
T18	-0.201	
	(0.045)	
T19	-0.276	
	(0.044)	
T20	-0.320	
	(0.045)	
T21	-0.295	
	(0.045)	
T22	-0.246	
	(0.045)	
T23	-0.281	
	(0.046)	
T24	-0.341	
	(0.046)	
Adj. R2	0.972	0.970

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix C

MODS Group LSM

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	0.625	0.706
	(0.072)	(0.027)
TPH2	0.015	0.016
	(0.004)	(0.002)
DPT	0.074	
	(0.029)	
T7	-0.097	
	(0.092)	
T8	-0.152	
	(0.145)	
T9	-0.130	
	(0.178)	
T10	-0.054	
	(0.199)	
T11	-0.135	
	(0.212)	
T12	-0.180	
	(0.221)	
T13	-0.128	
	(0.226)	
T14	-0.053	
	(0.229)	
T15	-0.116	
	(0.231)	
T16	-0.181	
	(0.233)	
T17	-0.263	
	(0.234)	
T18	-0.228	
	(0.235)	
T19	-0.370	
	(0.237)	
T20	-0.624	
	(0.239)	
T21	-0.596	
	(0.243)	
T22	-0.612	
	(0.243)	
T23	-0.886	
	(0.246)	
T24	-0.976	
	(0.254)	
Adj. R2	0.898	0.895

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix C

MODS Group BCS

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	0.787	1.196
	(0.056)	(0.010)
TPH2	-0.013	-0.023
	(0.002)	(0.001)
DPT	0.267	
	(0.027)	
T7	0.022	
	(0.016)	
T8	0.018	
	(0.022)	
T9	0.055	
	(0.026)	
T10	0.058	
	(0.028)	
T11	0.066	
	(0.029)	
T12	0.049	
	(0.03)	
T13	0.100	
	(0.03)	
T14	0.086	
	(0.031)	
T15	0.103	
	(0.031)	
T16	0.132	
	(0.031)	
T17	0.208	
	(0.031)	
T18	0.201	
	(0.031)	
T19	0.204	
	(0.032)	
T20	0.192	
	(0.031)	
T21	0.258	
	(0.032)	
T22	0.260	
	(0.032)	
T23	0.295	
	(0.032)	
T24	0.238	
	(0.032)	
Adj. R2	0.984	0.982

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix C

MODS Group FSM

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	1.213	1.086
	(0.05)	(0.009)
TPH2	-0.029	-0.011
	(0.003)	(0.001)
DPT	0.041	
	(0.019)	
T7	0.070	
	(0.014)	
T8	0.024	
	(0.019)	
T9	0.094	
	(0.021)	
T10	0.048	
	(0.022)	
T11	0.089	
	(0.023)	
T12	0.020	
	(0.023)	
T13	0.104	
	(0.023)	
T14	0.050	
	(0.023)	
T15	0.082	
	(0.023)	
T16	0.020	
	(0.023)	
T17	0.129	
	(0.023)	
T18	0.064	
	(0.023)	
T19	0.115	
	(0.023)	
T20	0.084	
	(0.023)	
T21	0.179	
	(0.023)	
T22	0.127	
	(0.023)	
T23	0.183	
	(0.023)	
T24	0.136	
	(0.023)	
Adj. R2	0.991	0.987

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix C

MODS Group Manual Flats

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	1.255	0.919
	(0.037)	(0.007)
TPH2	-0.015	0.006
	(0.002)	(0.001)
DPT	-0.106	
	(0.013)	
T7	-0.001	
	(0.008)	
T8	-0.007	
	(0.014)	
T9	0.011	
	(0.018)	
T10	0.006	
	(0.022)	
T11	0.004	
	(0.025)	
T12	0.008	
	(0.028)	
T13	0.012	
	(0.031)	
T14	0.009	
	(0.033)	
T15	0.010	
	(0.035)	
T16	0.009	
	(0.036)	
T17	0.016	
	(0.038)	
T18	0.001	
	(0.039)	
T19	-0.005	
	(0.04)	
T20	-0.018	
	(0.041)	
T21	-0.005	
	(0.042)	
T22	-0.033	
	(0.043)	
T23	-0.055	
	(0.043)	
T24	-0.084	
	(0.044)	
Adj. R2	0.986	0.986

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix C

MODS Group Manual Letters

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	1.038	1.037
	(0.038)	(0.007)
TPH2	-0.011	-0.009
	(0.002)	(0.001)
DPT	0.011	
	(0.015)	
T7	-0.024	
	(0.011)	
T8	-0.053	
	(0.017)	
T9	-0.020	
	(0.022)	
T10	-0.046	
	(0.025)	
T11	-0.064	
	(0.028)	
T12	-0.079	
	(0.03)	
T13	-0.036	
	(0.031)	
T14	-0.061	
	(0.032)	
T15	-0.068	
	(0.033)	
T16	-0.079	
	(0.033)	
T17	-0.025	
	(0.034)	
T18	-0.033	
	(0.034)	
T19	-0.040	
	(0.034)	
T20	-0.050	
	(0.034)	
T21	-0.026	
	(0.034)	
T22	-0.049	
	(0.035)	
T23	-0.067	
	(0.035)	
T24	-0.090	
	(0.035)	
Adj. R2	0.990	0.989

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix C

MODS Group Priority

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	1.032	1.013
	(0.01)	(0.005)
TPH2	-0.003	-0.002
	(0.001)	(0.000)
DPT	-0.003	
	(0.003)	
T7	0.010	
	(0.007)	
T8	0.010	
	(0.008)	
T9	0.014	
	(0.009)	
T10	0.018	
	(0.009)	
T11	0.010	
	(0.009)	
T12	0.013	
	(0.009)	
T13	0.020	
	(0.009)	
T14	0.019	
	(0.009)	
T15	0.024	
	(0.009)	
T16	0.010	
	(0.009)	
T17	0.016	
	(0.009)	
T18	0.021	
	(0.009)	
T19	0.013	
	(0.009)	
T20	0.016	
	(0.009)	
T21	0.017	
	(0.009)	
T22	0.021	
	(0.009)	
T23	0.018	
	(0.009)	
T24	0.015	
	(0.009)	
Adj. R2	0.998	0.998

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix D

Shape Group Letters
Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	1.140	1.307
	(0.077)	(0.013)
TPH2	-0.026	-0.029
	(0.003)	(0.001)
DPT	0.122	
	(0.038)	
T7	-0.037	
	(0.013)	
T8	-0.068	
	(0.014)	
T9	-0.023	
	(0.014)	
T10	-0.007	
	(0.014)	
T11	-0.052	
	(0.014)	
T12	-0.039	
	(0.014)	
T13	-0.022	
	(0.014)	
T14	-0.014	
	(0.014)	
T15	-0.033	
	(0.014)	
T16	-0.043	
	(0.014)	
T17	0.010	
	(0.014)	
T18	0.017	
	(0.015)	
T19	-0.013	
	(0.014)	
T20	-0.045	
	(0.014)	
T21	0.000	
	(0.014)	
T22	0.013	
	(0.015)	
T23	0.021	
	(0.015)	
T24	-0.046	
	(0.014)	
Adj. R2	0.987	0.987

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix D

Shape Group Flats

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	0.897	1.036
	(0.036)	(0.007)
TPH2	-0.007	-0.027
	(0.002)	(0.001)
DPT	0.117	
	(0.015)	
T7	0.035	
	(0.014)	
T8	-0.005	
	(0.007)	
T9	0.045	
	(0.011)	
T10	0.011	
	(0.011)	
T11	0.035	
	(0.011)	
T12	-0.013	
	(0.011)	
T13	0.046	
	(0.011)	
T14	0.006	
	(0.011)	
T15	0.026	
	(0.011)	
T16	-0.014	
	(0.011)	
T17	0.064	
	(0.011)	
T18	0.014	
	(0.011)	
T19	0.043	
	(0.011)	
T20	0.019	
	(0.011)	
T21	0.091	
	(0.011)	
T22	0.048	
	(0.011)	
T23	0.081	
	(0.011)	
T24	0.044	
	(0.011)	
Adj. R2	0.996	0.994

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix D

Shape Group Parcels

Dependent Variable: FHP

Variable	Full Specification	Partial Specification
TPH	1.062	1.221
	(0.101)	(0.028)
TPH2	-0.032	-0.042
	(0.008)	(0.003)
DPT	0.039	
	(0.027)	
T7	-0.055	
	(0.039)	
T8	-0.168	
	(0.058)	
T9	-0.169	
	(0.071)	
T10	-0.107	
	(0.081)	
T11	-0.150	
	(0.088)	
T12	-0.179	
	(0.093)	
T13	-0.153	
	(0.096)	
T14	-0.083	
	(0.099)	
T15	-0.166	
	(0.101)	
T16	-0.216	
	(0.103)	
T17	-0.184	
	(0.105)	
T18	-0.189	
	(0.107)	
T19	-0.314	
	(0.108)	
T20	-0.202	
	(0.109)	
T21	-0.296	
	(0.110)	
T22	-0.316	
	(0.110)	
T23	-0.429	
	(0.111)	
T24	-0.564	
	(0.112)	
Adj. R2	0.798	0.792

Notes and Sources:

1. Data from reg9398.xls and fhp9398.xls, in USPS-LR-I-107 and USPS-LR-I-186, respectively.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation within panels. Standard errors shown in parentheses.

Appendix E

Wage Regression Results: Letters

Missing wage values filled with predicted wages from this regression.
Sample size increased from 6834 to 7296.
R2 = 0.750

Site	Bhat	Se
1	3.177	0.566
2	3.245	0.566
3	3.166	0.566
4	3.176	0.566
5	3.151	0.566
6	3.175	0.566
7	3.182	0.566
8	3.133	0.566
9	3.209	0.566
10	3.112	0.566
11	3.256	0.566
12	3.213	0.566
13	3.167	0.566
14	3.280	0.566
15	3.167	0.566
16	3.210	0.566
19	3.247	0.566
20	3.197	0.566
21	3.176	0.566
22	3.155	0.578
23	3.180	0.566
24	3.208	0.566
25	3.230	0.566
26	3.145	0.566
28	3.164	0.566
29	3.161	0.566
30	3.163	0.566
31	3.131	0.566
32	3.208	0.578
33	3.211	0.648
34	3.271	0.648
35	3.146	0.566
36	3.228	0.756
38	3.133	0.566
39	3.123	0.566
40	3.284	0.685
42	3.208	0.566
43	3.003	0.566
44	3.216	0.706
45	3.148	0.566
46	3.186	0.566
47	3.204	0.566
48	3.181	0.566
49	3.156	0.566
50	3.142	0.566
51	3.088	0.566
52	3.148	0.566
53	3.122	0.566
55	3.144	0.566
57	3.049	0.857
58	3.203	0.566
59	3.208	0.566
60	3.144	0.566
61	3.202	0.566
62	3.218	0.566
63	3.153	0.566
64	3.211	0.566
65	3.198	0.566
66	3.143	0.566
67	3.176	0.566
68	3.172	0.566
69	3.147	0.566
70	3.153	0.566
71	3.190	0.566
72	3.136	0.566
73	3.157	0.566
74	3.217	0.566
75	3.130	0.566
76	3.220	0.566
77	3.129	0.566
78	3.244	0.578
79	3.158	0.566
80	3.227	0.566
81	3.150	0.566
82	3.080	0.566
83	3.206	0.566
84	3.181	0.566
85	3.138	0.566
86	3.247	0.616
88	3.130	0.902
89	3.226	0.566
90	3.184	0.566
91	3.141	0.566
92	3.160	0.566
93	3.171	0.566
94	3.161	0.955
95	3.170	0.566
96	3.093	0.566
97	3.172	0.566
98	3.099	0.566
99	3.096	0.566
100	3.168	0.566
101	3.129	0.648
102	3.118	0.566
103	3.106	0.566
104	3.204	0.602
105	3.127	0.566
106	3.093	1.023
107	3.103	0.566
108	3.151	0.566
109	3.221	0.706
110	3.157	0.566
111	3.172	0.566
112	3.148	0.566
113	3.134	0.578
114	3.165	0.566
115	3.133	0.566
116	3.098	0.566
117	3.228	0.860
118	3.177	0.566
119	3.115	0.566
121	3.082	2.670
122	3.131	0.566
123	3.144	0.566
124	3.220	2.679
125	3.191	0.566
127	3.135	0.648
128	3.135	0.566
129	3.144	0.566
130	3.160	0.566

Appendix E

Site	Bhat	Se
131	3.159	0.566
132	3.197	0.566
133	3.202	0.566
134	3.146	0.566
135	3.183	0.566
136	3.152	0.566
137	3.164	0.566
138	3.218	0.566
139	3.132	0.566
140	3.121	0.566
141	3.141	0.566
142	3.240	0.566
143	3.109	0.566
144	3.209	0.566
145	3.110	0.566
146	3.216	0.566
147	3.127	0.566
148	3.144	0.566
149	3.177	0.566
150	3.124	0.566
151	3.097	0.566
152	2.982	0.566
153	3.133	0.566
154	3.175	0.566
155	3.220	0.566
156	3.129	0.566
157	3.125	0.590
158	3.134	0.566
159	3.143	0.566
160	3.105	0.579
161	3.047	0.566
162	3.132	0.566
163	3.139	0.566
164	3.091	0.566
165	3.195	0.566
166	3.095	0.566
167	3.186	0.566
168	3.104	0.566
169	3.081	0.566
170	3.130	0.566
171	3.152	0.566
172	3.134	0.566
173	3.125	0.590
174	3.162	0.566
175	3.088	0.566
176	3.178	0.566
177	3.112	0.590
178	3.204	0.566
179	3.105	0.566
180	3.119	0.566
181	3.159	0.566
182	3.127	0.566
183	3.025	0.566
184	3.118	0.566
185	3.058	0.578
186	3.049	0.566
187	3.156	0.566
188	3.106	0.566
189	3.036	0.578
190	3.154	0.566
191	3.095	0.616
192	3.096	0.592
193	3.251	0.566
194	3.112	0.566
195	3.160	0.566
196	3.014	0.633
198	3.178	0.566
199	3.152	0.566
200	3.080	0.566
201	3.112	0.566
202	3.112	0.566
203	3.137	0.566
204	3.155	0.566
205	3.181	0.566
206	3.154	0.566
207	3.137	0.566
208	3.203	0.566
209	3.165	0.566
210	3.168	0.566
211	3.151	0.566
212	3.233	0.566
213	3.161	0.566
214	3.195	0.566
215	3.224	0.566
216	3.185	0.566
217	3.157	0.566
219	3.184	0.566
220	3.187	0.631
221	3.161	2.679
222	3.200	0.566
223	3.145	0.566
224	3.218	0.566
225	3.121	0.566
226	3.160	0.566
227	3.143	0.631
228	3.187	1.547
229	3.148	0.566
230	3.155	0.566
233	3.240	0.822
234	3.141	0.566
235	3.220	1.897
236	3.047	0.955
237	3.204	0.566
238	3.081	0.566
239	3.168	0.566
240	3.125	0.857
241	3.173	0.566
242	3.116	0.566
243	3.162	0.566
244	3.079	0.706
245	3.157	0.566
246	3.198	1.898
247	3.189	0.566
249	3.136	0.566
250	3.171	0.566
251	3.114	0.685
252	3.126	0.685
253	3.200	0.566
254	3.173	0.566
255	3.179	0.566
256	3.054	0.602
257	3.169	0.602
258	3.132	0.566
259	3.193	0.566
260	3.125	0.566
261	3.154	0.616
262	3.176	0.566
263	3.132	2.679
264	3.171	0.566
265	3.133	0.959
268	3.137	0.566
269	3.227	0.566
270	3.161	0.566
271	3.139	0.566
272	3.120	0.566
273	3.149	0.566
274	3.078	0.566
275	3.147	0.566
276	3.193	0.566
277	3.158	0.566
278	3.133	0.566
279	3.069	0.566
280	3.214	0.566
281	3.158	0.566

Appendix E

Site	Bhat	Se
282	3.129	0.566
283	3.216	0.566
284	3.189	0.566
285	3.257	0.566
286	3.131	0.566
287	3.111	0.566
288	3.202	0.566
289	3.233	0.566
290	3.091	0.566
291	3.080	0.566
292	3.099	0.566
293	3.211	0.566
294	3.127	0.566
295	3.109	0.566
296	3.108	0.566
297	3.294	0.566
298	3.139	0.566
299	3.184	0.566
300	3.124	0.566
301	3.102	1.206
302	3.127	0.566
303	3.134	0.602
304	3.117	0.566
305	3.159	0.566
306	3.155	0.602
307	3.179	0.566
308	3.144	0.566
309	3.124	0.566
310	3.155	0.566
311	3.206	0.578
312	3.185	0.566
313	3.128	0.590
314	3.159	0.566
315	3.214	0.566
316	3.136	0.566
317	3.198	0.566
318	3.144	0.616
319	3.204	0.566
320	3.067	0.566
321	3.125	0.579

Period	Bhat	Se
2	0.002	0.222
3	0.023	0.222
4	0.029	0.222
5	0.010	0.222
6	0.011	0.222
7	0.036	0.222
8	0.045	0.222
9	0.023	0.222
10	0.006	0.222
11	0.024	0.223
12	0.044	0.223
13	0.033	0.223
14	0.035	0.223
15	0.058	0.223
16	0.079	0.223
17	0.068	0.224
18	0.049	0.224
19	0.077	0.225
20	0.096	0.225
21	0.079	0.227
22	0.069	0.226
23	0.105	0.226
24	0.119	0.227

Notes and Source:

1. Data from reg9398.xls in USPS-LR-I-107.
2. Parameters estimated using Ordinary Least Squares.

Appendix E

Wage Regression Results: Flats

Missing wage values filled with predicted wages from this regression.
Sample size increased from 6858 to 7296.
R2 = 0.715

Site	Bhat	Se
1	3.248	0.630
2	3.255	0.630
3	3.204	0.630
4	3.223	0.630
5	3.202	0.630
6	3.180	0.630
7	3.202	0.630
8	3.183	0.630
9	3.202	0.630
10	3.151	0.630
11	3.276	0.630
12	3.272	0.630
13	3.219	0.630
14	3.303	0.630
15	3.204	0.630
16	3.268	0.630
19	3.277	0.630
20	3.207	0.630
21	3.217	0.630
22	3.179	0.642
23	3.204	0.630
24	3.248	0.630
25	3.320	0.630
26	3.187	0.630
28	3.199	0.630
29	3.175	0.630
30	3.199	0.630
31	3.141	0.630
32	3.240	0.642
33	3.259	0.720
34	3.294	0.720
35	3.167	0.630
36	3.251	0.841
38	3.108	0.630
39	3.162	0.630
40	3.319	0.762
42	3.219	0.630
43	3.109	0.630
44	3.214	0.785
45	3.160	0.630
46	3.173	0.630
47	3.227	0.630
48	3.189	0.630
49	3.231	0.630
50	3.153	0.630
51	3.145	0.630
52	3.144	0.630
53	3.122	0.630
55	3.164	0.630
57	3.070	0.954
58	3.234	0.630
59	3.213	0.630
60	3.197	0.630
61	3.204	0.630
62	3.237	0.630
63	3.136	0.630
64	3.222	0.630
65	3.231	0.630
66	3.172	0.630
67	3.172	0.630
68	3.196	0.630
69	3.192	0.630
70	3.227	0.630
71	3.222	0.630
72	3.148	0.630
73	3.195	0.630
74	3.267	0.630
75	3.164	0.630
76	3.246	0.630
77	3.139	0.630
78	3.275	0.642
79	3.195	0.630
80	3.242	0.630
81	3.176	0.630
82	3.099	0.630
83	3.216	0.630
84	3.183	0.630
85	3.161	0.630
86	3.262	0.686
88	3.188	1.004
89	3.304	0.630
90	3.201	0.630
91	3.161	0.630
92	3.180	0.630
93	3.192	0.630
94	3.165	1.063
95	3.189	0.630
96	3.147	0.630
97	3.178	0.630
98	3.151	0.630
99	3.096	0.630
100	3.186	0.630
101	3.143	0.720
102	3.151	0.630
103	3.136	0.630
104	3.251	0.670
105	3.125	0.630
106	3.109	1.138
107	3.116	0.630
108	3.172	0.630
109	3.256	0.785
110	3.171	0.630
111	3.216	0.630
112	3.151	0.630
113	3.156	0.642
114	3.208	0.630
115	3.140	0.630
116	3.112	0.630
117	3.240	0.642
118	3.168	0.630
119	3.159	0.630
121	3.111	2.971
122	3.165	0.630
123	3.226	0.630
124	3.255	2.981
125	3.227	0.630
127	3.149	0.720
128	3.137	0.630
129	3.197	0.630
130	3.178	0.630
131	3.200	0.630
132	3.241	0.630
133	3.252	0.630

Appendix E

Site	Bhat	Se
134	3.176	0.630
135	3.220	0.630
136	3.168	0.630
137	3.185	0.630
138	3.257	0.630
139	3.177	0.630
140	3.145	0.630
141	3.220	0.630
142	3.265	0.630
143	3.161	0.630
144	3.206	0.630
145	3.111	0.630
146	3.286	0.630
147	3.116	0.630
148	3.166	0.630
149	3.222	0.630
150	3.174	0.630
151	3.083	0.630
152	3.052	0.630
153	3.144	0.630
154	3.196	0.630
155	3.278	0.630
156	3.183	0.630
157	3.134	0.656
158	3.147	0.630
159	3.171	0.630
160	3.120	0.630
161	3.089	0.630
162	3.207	0.630
163	3.183	0.630
164	3.146	0.630
165	3.244	0.630
166	3.139	0.630
167	3.204	0.630
168	3.132	0.630
169	3.113	0.630
170	3.147	0.630
171	3.162	0.630
172	3.120	0.630
173	3.134	0.656
174	3.174	0.630
175	3.117	0.630
176	3.214	0.630
177	3.146	0.642
178	3.220	0.630
179	3.095	0.630
180	3.136	0.630
181	3.174	0.630
182	3.239	0.630
183	3.081	0.630
184	3.147	0.630
185	3.137	0.630
186	3.043	0.630
187	3.176	0.630
188	3.145	0.630
189	3.083	0.642
190	3.188	0.630
191	3.091	0.686
192	3.135	0.658
193	3.275	0.630
194	3.164	0.630
195	3.174	0.630
196	3.063	0.705
198	3.217	0.630
199	3.155	0.630
200	3.108	0.630
201	3.155	0.630
202	3.127	0.630
203	3.185	0.630
204	3.202	0.630
205	3.195	0.630
206	3.190	0.630
207	3.165	0.630
208	3.202	0.630
209	3.195	0.630
210	3.188	0.630
211	3.162	0.630
212	3.265	0.630
213	3.175	0.630
214	3.213	0.630
215	3.237	0.630
216	3.186	0.630
217	3.223	0.630
219	3.216	0.630
220	3.204	0.702
221	3.195	2.981
222	3.222	0.630
223	3.177	0.630
224	3.231	0.630
225	3.144	0.630
226	3.203	0.630
227	3.181	0.702
228	3.207	1.721
229	3.175	0.630
230	3.164	0.630
233	3.267	0.702
234	3.164	0.630
235	3.237	2.111
236	3.080	1.063
237	3.230	0.630
238	3.092	0.630
239	3.184	0.630
240	3.152	0.954
241	3.190	0.630
242	3.121	0.630
243	3.159	0.630
244	3.125	0.785
245	3.183	0.630
246	3.232	2.112
247	3.227	0.630
249	3.149	0.630
250	3.187	0.630
251	3.145	0.762
252	3.146	0.762
253	3.212	0.630
254	3.182	0.630
255	3.180	0.630
256	3.080	0.670
257	3.198	0.670
258	3.148	0.630
259	3.189	0.630
260	3.158	0.630
261	3.169	0.686
262	3.199	0.630
263	3.143	2.981
264	3.178	0.630
265	3.153	1.067
268	3.189	0.630
269	3.243	0.630
270	3.241	0.630
271	3.198	0.630
272	3.188	0.630
273	3.180	0.630
274	3.127	0.630
275	3.195	0.630
276	3.203	0.630
277	3.226	0.630
278	3.190	0.630
279	3.098	0.630
280	3.252	0.630
281	3.201	0.630
282	3.201	0.630
283	3.248	0.630
284	3.235	0.630

Appendix E

Site	Bhat	Se
285	3.271	0.630
286	3.155	0.630
287	3.135	0.630
288	3.240	0.630
289	3.247	0.630
290	3.145	0.630
291	3.133	0.630
292	3.119	0.630
293	3.229	0.630
294	3.189	0.630
295	3.133	0.630
296	3.114	0.630
297	3.343	0.630
298	3.155	0.630
299	3.216	0.630
300	3.133	0.630
301	3.152	1.342
302	3.156	0.630
303	3.189	0.670
304	3.136	0.630
305	3.189	0.630
306	3.165	0.670
307	3.224	0.630
308	3.145	0.630
309	3.151	0.630
310	3.186	0.630
311	3.234	0.642
312	3.228	0.630
313	3.141	0.656
314	3.195	0.630
315	3.232	0.630
316	3.172	0.630
317	3.213	0.630
318	3.166	0.686
319	3.237	0.630
320	3.130	0.630
321	3.189	0.644

Period	Bhat	Se
2	-0.003	0.246
3	0.021	0.245
4	0.027	0.246
5	0.001	0.246
6	-0.003	0.246
7	0.028	0.246
8	0.040	0.246
9	0.016	0.246
10	-0.006	0.246
11	0.018	0.247
12	0.038	0.247
13	0.026	0.247
14	0.024	0.247
15	0.054	0.247
16	0.077	0.248
17	0.064	0.248
18	0.038	0.249
19	0.075	0.249
20	0.092	0.250
21	0.068	0.252
22	0.046	0.251
23	0.093	0.251
24	0.104	0.252

Notes and Source:

1. Data from reg9398.xls in USPS-LR-I-107.
2. Parameters estimated using Ordinary Least Squares.

Appendix E

Wage Regression Results: Parcels

Missing wage values filled with predicted wages from this regression.
Sample size increased from 3895 to 7056.
R2 = 0.725

Site	Bhat	Se
1	3.173	0.618
2	3.186	0.618
3	3.109	0.618
4	3.130	0.642
5	3.079	0.618
6	3.085	0.618
7	3.145	0.618
8	3.079	0.618
9	3.109	0.618
10	3.048	0.726
11	3.219	0.618
12	3.144	1.182
13	3.124	0.794
14	3.267	0.618
15	3.096	0.618
16	3.201	0.789
19	3.263	0.925
20	3.114	0.618
21	3.151	0.618
22	3.068	0.671
23	3.126	0.618
24	3.189	0.618
25	3.180	0.618
26	3.084	0.618
27	2.832	1.034
28	3.140	0.765
29	3.106	0.726
30	3.124	0.659
31	2.993	1.298
32	3.143	2.872
33	3.210	2.873
35	3.151	1.658
36	3.213	1.667
38	3.049	0.618
39	3.047	0.643
42	3.171	0.630
43	2.982	0.930
44	3.100	1.439
45	3.086	0.618
46	3.091	0.671
48	3.011	0.659
49	3.081	0.618
50	3.086	1.034
51	2.971	2.872
52	2.977	2.872
53	3.066	0.618
54	3.214	2.871
55	3.101	0.618
57	3.017	2.025
58	3.106	0.618
59	3.131	0.618
60	3.083	0.690
61	3.158	0.618
62	3.144	0.618
63	3.013	0.642
64	3.094	0.618
65	3.132	0.618
66	3.062	0.618
67	3.082	0.618
68	3.089	0.618
69	3.073	0.618
70	3.193	0.642
71	3.076	0.618
72	3.036	0.618
73	3.082	0.618
74	3.216	0.642
75	3.025	0.687
76	3.134	0.618
77	3.022	0.853
78	3.087	0.630
79	3.089	0.618
80	3.110	0.618
81	3.047	0.670
82	2.983	0.646
83	3.067	0.618
84	3.189	1.096
85	3.051	0.849
86	3.207	1.447
87	3.207	0.742
88	3.150	2.035
89	3.158	2.855
90	3.122	1.097
91	3.050	0.929
92	3.068	0.889
93	3.066	1.029
94	3.160	0.742
95	3.071	0.618
96	3.052	0.817
97	3.090	1.181
98	3.026	0.743
99	3.010	0.742
100	3.116	0.686
102	3.036	0.789
103	3.095	0.930
104	3.185	1.034
105	2.987	0.817
106	3.101	0.765
107	3.024	0.618
108	3.059	0.618
109	3.244	1.658
110	3.080	0.790
111	3.143	1.034
112	3.166	0.972
113	3.114	0.742
114	3.109	1.298
115	2.986	0.707
116	2.924	2.025
117	3.173	1.097
118	3.065	0.769
119	3.066	0.618
120	3.124	2.025
121	3.142	2.036
122	3.097	0.742
123	3.170	2.855
124	3.243	0.848
125	3.176	0.848
127	3.079	1.658
128	3.061	0.646
129	3.101	0.618
130	3.007	1.028
131	3.149	0.618
132	3.184	0.618
133	3.138	0.618

Appendix E

Site	Bhat	Se
134	3.076	0.618
135	3.131	0.618
136	3.080	0.618
137	3.036	0.618
138	3.140	0.618
139	3.086	0.618
140	3.083	0.618
141	3.167	0.618
142	3.178	0.618
143	3.087	0.618
144	3.139	0.618
145	2.991	0.618
146	3.206	0.618
147	2.963	1.102
148	3.081	0.674
149	3.114	1.034
150	3.088	0.618
151	3.067	1.188
152	2.880	1.188
153	2.953	0.630
154	3.015	0.618
155	3.146	0.618
156	3.120	0.671
157	3.081	1.097
159	3.123	2.025
160	3.154	1.447
161	2.966	1.181
162	3.150	2.037
163	3.111	2.871
164	3.051	0.703
166	3.078	2.025
167	3.133	1.029
168	3.066	1.658
169	2.940	1.658
170	2.951	2.872
171	3.150	2.037
172	3.060	0.618
173	3.079	0.889
174	3.147	1.447
175	3.068	1.181
176	3.131	2.873
177	2.953	2.025
178	3.119	1.029
179	2.943	1.439
180	3.016	2.872
181	3.230	2.871
182	3.204	0.978
183	2.852	2.855
184	3.044	1.667
185	3.036	1.291
186	2.822	1.188
188	3.110	1.448
189	2.907	1.666
190	3.095	1.658
192	3.118	2.036
193	3.206	0.618
194	2.963	0.630
195	3.084	0.618
196	2.972	0.690
198	3.100	0.618
199	3.077	0.618
200	2.974	0.930
201	3.091	0.618
202	3.055	0.618
203	3.073	0.618
204	3.150	0.618
205	3.079	0.972
206	3.074	0.618
207	2.974	0.618
208	3.095	1.291
209	3.066	0.656
210	3.052	0.630
211	3.110	1.182
212	3.188	0.817
213	3.097	0.618
214	3.157	0.618
215	3.190	0.618
216	3.176	0.972
217	3.164	0.618
219	3.109	0.884
220	3.143	2.871
221	3.031	1.181
222	3.142	2.037
223	3.111	0.925
224	3.146	2.872
225	3.108	2.025
226	3.147	1.188
227	3.039	2.871
228	3.188	2.025
229	3.011	1.666
230	3.080	1.182
232	3.117	1.658
233	3.190	1.658
234	3.103	2.872
235	3.218	1.291
236	3.025	0.848
237	3.137	1.029
238	3.054	0.972
239	3.081	2.871
240	3.115	2.872
241	3.020	2.855
242	3.021	0.618
243	3.098	1.440
244	3.047	2.025
245	3.100	0.972
247	3.114	1.658
248	3.103	2.872
249	3.029	1.298
250	3.110	0.618
251	3.131	2.025
252	3.099	2.036
253	3.088	1.181
254	3.097	0.790
255	3.072	1.029
256	2.978	2.855
257	3.117	1.097
258	3.097	1.097
259	3.086	2.025
260	3.087	0.690
261	3.123	1.182
262	3.110	2.872
263	3.078	1.439
264	3.089	0.849
265	3.151	1.440
268	3.120	0.618
269	3.159	0.618
270	3.170	0.618
271	3.122	0.618
272	3.087	0.618
273	3.084	0.618
274	2.972	0.618
275	3.070	0.630
276	3.137	0.618
277	3.146	0.618
278	3.112	0.978
279	3.034	1.182
280	3.131	0.618
281	3.049	0.618
282	3.090	0.618
283	3.153	0.671
284	3.160	0.618
285	3.132	1.291
286	3.087	2.855
287	3.116	0.707

Appendix E

Site	Bhat	Se
288	3.205	2.037
289	3.173	0.790
290	3.063	2.037
291	3.097	1.188
292	3.068	0.765
293	3.150	0.977
294	3.108	1.029
295	3.045	1.658
296	2.988	1.034
297	3.280	1.181
298	3.064	1.188
300	3.075	1.188
301	3.095	2.855
302	3.074	1.291
304	3.084	0.972
307	3.088	1.034
308	2.989	1.668
309	3.086	1.298
310	3.146	2.855
311	3.108	2.025
313	3.032	1.667
314	3.157	2.855
315	3.160	2.873
316	3.104	1.447
317	3.135	1.658
320	3.129	1.447
321	3.211	2.855

Period	Bhat	Se
2	-0.019	0.296
3	0.028	0.308
4	0.024	0.307
5	0.004	0.310
6	-0.016	0.314
7	0.036	0.313
8	0.045	0.311
9	0.026	0.313
10	-0.020	0.313
11	0.027	0.317
12	0.044	0.317
13	0.040	0.319
14	0.022	0.318
15	0.067	0.318
16	0.091	0.318
17	0.088	0.314
18	0.042	0.310
19	0.105	0.309
20	0.121	0.308
21	0.105	0.304
22	0.076	0.301
23	0.139	0.302
24	0.148	0.301

Notes and Source:

1. Data from reg9398.xls in USPS-LR-I-107.
2. Parameters estimated using Ordinary Least Squares.

Appendix F

Labor Demand Estimates for Letters

Variable	Coefficient	Standard Error
TPH	2.001	0.340
TPH2	-0.168	0.009
MAN	-0.066	0.245
MAN2	0.035	0.007
TTREND	-0.114	0.020
TTREND2	0.000	0.000
DPT	-0.258	0.456
DPT2	0.056	0.022
QICAP	-0.163	0.253
QICAP2	0.004	0.006
WAGE	0.769	1.170
WAGE2	0.002	0.226
LNT_M	-0.045	0.012
LNT_TR	0.001	0.001
LNT_D	0.097	0.020
LNT_CAP	0.157	0.013
LNT_W	-0.291	0.097
LNM_TR	0.000	0.001
LNM_D	-0.002	0.016
LNM_C	0.032	0.010
LNM_W	0.158	0.072
TR_D	0.010	0.001
TR_C	-0.005	0.001
TR_W	0.008	0.006
LND_C	-0.164	0.018
LND_W	0.048	0.110
LNC_W	0.118	0.073
QTR2	0.052	0.003
QTR3	-0.004	0.003
QTR4	-0.029	0.003
TPHLAG1	-0.192	0.091
TPHLAG2	0.068	0.088
TPHLAG3	-0.207	0.085
TPHLAG4	-0.399	0.071
TPHL12	0.009	0.004
TPHL22	0.000	0.004
TPHL32	0.012	0.004
TPHL42	0.019	0.003
Adj R2	0.997	
Estimated Rho	0.650	
Sample Size	4807	
Volume Variability	0.663	0.023

Notes and Sources:

1. Data from reg9398.xls in USPS-LR-I-107.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation.

Appendix F

Labor Demand Estimates for Flats

Variable	Coefficient	Standard Error
TPH	2.254	0.314
TPH2	-0.095	0.010
MAN	-0.349	0.184
MAN2	0.010	0.004
TTREND	-0.012	0.018
TTREND2	0.001	0.000
DPT	0.487	0.383
DPT2	0.006	0.019
QICAP	-0.272	0.236
QICAP2	0.017	0.006
WAGE	-0.740	1.128
WAGE2	0.120	0.203
LNT_M	0.047	0.010
LNT_TR	0.001	0.001
LNT_D	0.026	0.017
LNT_CAP	0.011	0.012
LNT_W	-0.105	0.083
LNM_TR	0.001	0.001
LNM_D	0.008	0.014
LNM_C	-0.005	0.010
LNM_W	-0.049	0.048
TR_D	0.004	0.001
TR_C	-0.002	0.001
TR_W	-0.010	0.005
LND_C	-0.044	0.018
LND_W	-0.041	0.085
LNC_W	0.101	0.066
QTR2	-0.012	0.004
QTR3	-0.018	0.003
QTR4	-0.037	0.004
TPHLAG1	0.182	0.101
TPHLAG2	-0.717	0.107
TPHLAG3	-0.157	0.097
TPHLAG4	-0.621	0.077
TPHL12	-0.006	0.005
TPHL22	0.043	0.006
TPHL32	0.011	0.005
TPHL42	0.036	0.004
Adj R2	0.996	
Estimated Rho	0.615	
Sample Size	4774	
Volume Variability	0.857	0.022

Notes and Sources:

1. Data from reg9398.xls in USPS-LR-I-107.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation.

Appendix F

Labor Demand Estimates for Parcels

Variable	Coefficient	Standard Error
TPH	0.052	0.338
TPH2	0.024	0.006
TTREND	-0.100	0.060
TTREND2	0.001	0.000
DPT	-0.657	1.093
DPT2	0.013	0.060
QICAP	2.483	0.751
QICAP2	0.015	0.026
WAGE	-5.313	3.396
WAGE2	0.952	0.570
LNT_TR	-0.002	0.001
LNT_D	-0.023	0.024
LNT_CAP	0.004	0.021
LNT_W	0.141	0.085
TR_D	0.005	0.004
TR_C	0.000	0.003
TR_W	0.006	0.017
LND_C	-0.064	0.062
LND_W	0.484	0.228
LNC_W	-0.618	0.187
QTR2	0.000	0.010
QTR3	-0.045	0.010
QTR4	-0.045	0.009
TPHLAG1	-0.073	0.066
TPHLAG2	-0.008	0.065
TPHLAG3	0.022	0.063
TPHLAG4	0.134	0.060
TPHL12	0.012	0.005
TPHL22	0.004	0.005
TPHL32	-0.001	0.005
TPHL42	-0.010	0.005
Adj R2	0.959	
Estimated Rho	0.589	
Sample Size	3651	
Volume Variability	0.750	0.034

Notes and Sources:

1. Data from reg9398.xls in USPS-LR-I-107.
2. Parameters estimated using FGLS, panel fixed effects estimation, allowing for AR(1) serial correlation.

IOCS Observations: Transition Matrix - from MODS to Classes

	BCS	OCR	FSM	LSM	SPBS	Manual Flats	Manual Letters	Manual Parcels	Priority
First Class	0.7765	0.8435	0.5079	0.9129	0.2227	0.4200	0.7872	0.1996	0.0455
Priority	0.0005	0.0011	0.0186	0.0028	0.2377	0.0243	0.0040	0.2816	0.9082
Express	0.0000	0.0000	0.0001	0.0000	0.0014	0.0005	0.0009	0.0067	0.0079
Mailgram	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0000	0.0000
Periodicals	0.0011	0.0005	0.0895	0.0000	0.1023	0.1950	0.0096	0.0377	0.0043
Standard A	0.2195	0.1522	0.3698	0.0761	0.3834	0.3436	0.1877	0.1818	0.0065
Standard B	0.0000	0.0000	0.0078	0.0000	0.0353	0.0107	0.0010	0.2705	0.0072
USPS	0.0024	0.0027	0.0057	0.0083	0.0113	0.0055	0.0089	0.0177	0.0202
Free Mail	0.0001	0.0000	0.0006	0.0000	0.0059	0.0003	0.0006	0.0044	0.0000

Source: 1998 IOCS data in UPS-Sellick-WP2.

Appendix H

MODS Labor Hours Used to Aggregate Mail Volumes Constructed Using IOCS Transition Matrix and 1998 MODS Workhours

First Class	107,089,718
Priority	10,921,907
Express	146,857
Periodicals	7,891,001
Standard A	42,002,705
Standard B	1,493,194

Source: 1998 IOCS Data in UPS-Sellick-WP2 and reg9398.xls in USPS-LR-I-107.

CHAIRMAN GLEIMAN: Mr. Neels, have you had an opportunity to examine the packet of designated written cross examination that was made available earlier this morning?

THE WITNESS: I have.

CHAIRMAN GLEIMAN: And if those questions were asked of you today, would your answers be the same as those you previously provided in writing?

THE WITNESS: They would.

CHAIRMAN GLEIMAN: No changes, additions or corrections?

THE WITNESS: No, sir.

CHAIRMAN GLEIMAN: That being the case, counsel, if you could please provide two copies of the designated written cross examination of Witness Neels to the reporter, I will direct that that material be received into evidence and transcribed into the record also.

[Designated Written Cross-Examination of Kevin Neels, UPS-T-1, was received into evidence and transcribed into the record.]

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, DC 20268-0001

Postal Rate and Fee Changes, 2000 Docket No. R2000-1

DESIGNATION OF WRITTEN CROSS-EXAMINATION
OF UNITED PARCEL SERVICE
WITNESS KEVIN NEELS
(UPS-T-1)

Party	Interrogatories
Association of American Publishers	AAP/UPS-T1-1, 4-5
United States Postal Service	AAP/UPS-T1-1-5 USPS/UPS-T1-1-50

Respectfully submitted,

Cyril J. Pittack
Acting Secretary

INTERROGATORY RESPONSES OF
UNITED PARCEL SERVICE
WITNESS KEVIN NEELS (T-1)
DESIGNATED AS WRITTEN CROSS-EXAMINATION

Interrogatory	Designating Parties
AAP/UPS-T1-1	AAP, USPS
AAP/UPS-T1-2	USPS
AAP/UPS-T1-3	USPS
AAP/UPS-T1-4	AAP, USPS
AAP/UPS-T1-5	AAP, USPS
USPS/UPS-T1-1	USPS
USPS/UPS-T1-2	USPS
USPS/UPS-T1-3	USPS
USPS/UPS-T1-4	USPS
USPS/UPS-T1-5	USPS
USPS/UPS-T1-6	USPS
USPS/UPS-T1-7	USPS
USPS/UPS-T1-8	USPS
USPS/UPS-T1-9	USPS
USPS/UPS-T1-10	USPS
USPS/UPS-T1-11	USPS
USPS/UPS-T1-12	USPS
USPS/UPS-T1-13	USPS
USPS/UPS-T1-14	USPS
USPS/UPS-T1-15	USPS
USPS/UPS-T1-16	USPS
USPS/UPS-T1-17	USPS
USPS/UPS-T1-18	USPS
USPS/UPS-T1-19	USPS
USPS/UPS-T1-20	USPS
USPS/UPS-T1-21	USPS
USPS/UPS-T1-22	USPS
USPS/UPS-T1-23	USPS
USPS/UPS-T1-24	USPS
USPS/UPS-T1-25	USPS
USPS/UPS-T1-26	USPS
USPS/UPS-T1-27	USPS
USPS/UPS-T1-28	USPS

USPS/UPS-T1-29	USPS
USPS/UPS-T1-30	USPS
USPS/UPS-T1-31	USPS
USPS/UPS-T1-32	USPS
USPS/UPS-T1-33	USPS
USPS/UPS-T1-34	USPS
USPS/UPS-T1-35	USPS
USPS/UPS-T1-36	USPS
USPS/UPS-T1-37	USPS
USPS/UPS-T1-38	USPS
USPS/UPS-T1-39	USPS
USPS/UPS-T1-40	USPS
USPS/UPS-T1-41	USPS
USPS/UPS-T1-42	USPS
USPS/UPS-T1-43	USPS
USPS/UPS-T1-44	USPS
USPS/UPS-T1-45	USPS
USPS/UPS-T1-46	USPS
USPS/UPS-T1-47	USPS
USPS/UPS-T1-48	USPS
USPS/UPS-T1-49	USPS
USPS/UPS-T1-50	USPS

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AAP/UPS-T1-1. On page 11 of your testimony at lines 20-22, you state that "[a] cost minimizing provider of mail processing services can be expected to alter systematically its procedures for processing mail in response to changes in mail volumes." With respect to this statement:

(a) Please state whether it is your opinion that the Postal Service is in fact a "cost minimizing provider of mail processing services." If you hold the opinion that the Postal Service is a cost minimizing provider of mail processing services, please provide all studies or other evidence you relied on in support of this opinion.

(b) Please state whether, for purposes of your testimony, you have assumed that the Postal Service is a "cost minimizing provider of mail processing services." If you have assumed that the Postal Service is a cost minimizing provider of mail processing services, please provide all studies or other evidence you relied on in support of this assumption.

Response to AAP/UPS-T1-1.

(a) It was not necessary, for the purposes of my testimony, to form an opinion about whether or not the Postal Service is a cost minimizing producer of mail processing services.

(b) The analysis presented in my testimony does not rely on any assumptions about whether or not the Postal Service is a cost minimizing provider of mail processing services.

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AAP/UPS-T1-2. On page 30 of your testimony (lines 8-9), you state that "[b]ecause the number of subclasses is very large, direct estimation of these cost elasticities is often not feasible." With respect to this statement, please provide an explanation as to why you believe that direct estimation of these cost elasticities is not feasible based on the number of subclasses. Please explain whether it is your opinion, or the opinion of the Postal Service, that the direct estimation of the cost elasticities is not possible.

Response to AAP/UPS-T1-2.

Subclass-level estimation is not feasible because of the paucity of subclass-level data. As far as I am aware, the only available information at the subclass level includes RPW volumes and data collected for the costing distribution, such as the IOCS and TRACS data. These limited data do not provide the degrees of freedom necessary to estimate model parameters econometrically.

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AAP/UPS-T1-3. On page 33 of your testimony (lines 7-11) you indicate that you have conducted an empirical investigation of the relationship between the volume of mail processed at a plant and the number of piece handlings at that plant. Please provide all results and supporting documentation pertaining to that investigation.

Response to AAP/UPS-T1-3.

I have conducted an empirical investigation of the relationship between the volume of mail processed at a plant and the number of piece handlings at that plant. Pages 33-38 and 60-63 of my testimony, UPS-T-1, contain a description of the investigation, the results, and a discussion of the implications of the findings for Dr. Bozzo's estimated variabilities. All supporting documentation, including programs, source data, and details about methodology used in this investigation, are included in UPS-Neels-WP-1. See the table, "Overview of Analysis Programs," located in the subdirectory of the workpapers entitled, "Appendix – Analysis Program Files," for a guide to the appropriate documentation.

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AAP/UPS-T1-4. On page 39 of your testimony (line 9) you state that "[t]he Postal Service has pursued automation as a cost saving strategy." With respect to this statement, please provide any analysis that you performed or that you relied upon which demonstrates that the Postal Service's pursuit of automation has in fact resulted in actual cost savings.

Response to AAP/UPS-T1-4.

I have not performed my own analysis to determine the effects of automation on Postal Service costs.

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AAP/UPS-T1-5. On page 40 of your testimony (lines 3-4) you describe a calculation of the elasticity of postal labor costs with respect to "piece handlings." Please explain why, in this analysis, you have studied labor costs as a function of piece handlings. Is it your testimony that the marginal cost of postal labor should or should not be measured as a function of piece handlings?

Response to AAP/UPS-T1-5.

On page 40 of my testimony, I study the calculation of the elasticity of postal labor costs with respect to "piece handlings" for the sole purpose of investigating the properties of Dr. Bozzo's variability estimates. This investigation, which is described on pages 39-46 of my testimony, UPS-T-1, uncovers the unreasonable implications of Dr. Bozzo's results.

It is my testimony that labor costs should *not* be measured as a function of piece handlings. See pages 30-34 of UPS-T-1.

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USPS/UPS-T1-1. Please refer to the curriculum vitae provided as Appendix A to your testimony, UPS-T-1. For each listed item following the "Testimony" heading, other than the Docket No. R97-1 item, please indicate whether your testimony pertained, in whole or in part, to an econometric analysis of panel data. If so, please provide a copy of the written testimony.

Response to USPS/UPS-T1-1. My testimony in the following matters pertained in whole or in part to an econometric analysis of panel data:

1. Before the U.S. District Court, District of Maryland, Testimony in the Matter of Borman Motor Company Limited Liability Co., et al. vs. American Honda Motor Company Inc., et al., Civil Action No. MDL-1069, August 1998;

2. Before the U.S. District Court, District of Kansas, Testimony in the Matter of Timothy Mellon vs. The Cessna Aircraft Company, Civil Action No. 96-1454-JTM, Expert Report, November 1997.

Copies of the above are being filed as library reference UPS-LR-1.

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USPS/UPS-T1-2. Please refer to your testimony, UPS-T-1, at page 32, lines 9-11. You state, "It would be even simpler for the Postal Service to dispense with the whole cost driver/distribution key approach and retain the traditional finding that mail processing labor costs are 100 percent volume-variable." See also witness Sellick's testimony, UPS-T-2, at page 2, lines 15-18, where Mr. Sellick states that he provides "a recalculation of base year Cost Segment 3 costs . . . using 100 percent mail processing labor cost variability as proposed by UPS witness Neels (UPS-T-1)."

a. Confirm that Mr. Sellick's calculations for cost segment 3.1 (mail processing labor) are consistent with your testimony, UPS-T-1. If you do not confirm, please explain fully.

b. Do you contend that the subclass "costs" for cost segment 3.1 computed by Mr. Sellick for UPS-T-2, divided by the corresponding RPW volume, have the economic interpretation of marginal cost? Please provide the economic interpretation you believe to be correct if your answer is negative in whole or in part

c. Please provide the precise economic interpretation(s) of the "100 percent mail processing labor cost variabilities" employed by Mr. Sellick for cost segment 3.1 That is, if you contend the 100 percent variabilities represent the elasticity of "X" with respect to "Y," provide a precise definition of "X" and "Y."

d. Please provide the precise economic interpretation(s) of the IOCS-based distribution key shares used by Mr. Sellick to compute mail processing "costs" by cost

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pool and subclass. Reconcile your answer, as necessary, with your responses to parts (b) and (c) of this interrogatory.

Response to USPS/UPS-T1-2.

(a) Confirmed. On pages 60-70 of my testimony, I present alternative calculations of the volume variability of mail processing labor costs. Almost all of these calculations yield variabilities equal to or in excess of 100 percent. The only noteworthy exception occurs in Tables 9 and 10 in connection with the Priority Mail MODS pool. As I note in my testimony (page 27, line 1-page 28, line 12), the Priority Mail data are subject to measurement error that appears to result in downward bias in the estimated volume variability. As I also state in my testimony (page 71, line 19-page 72, line 21), I am skeptical of the ability of MODS-level analyses to capture all of the effects of interactions between processing activities for purposes of computing volume variability. For these reasons, I am persuaded by the overall weight of the evidence, especially the results of the aggregate analysis reported on pages 63-70 of my testimony, that a volume variability of 100 percent is appropriate.

(b) I assume that you intend to ask whether I contend that the subclass costs for cost segment 3.1 computed by Mr. Sellick in UPS-T-2, divided by the corresponding RPW volume, represent marginal mail proceessing labor costs. Dividing Mr. Sellick's subclass costs by the corresponding RPW volumes does give the best approximations of the partial derivatives of mail processing labor costs with respect to subclass

volumes that are available in this record.

(c) "X" equals mail processing labor cost for a specific MODS pool. "Y" represents the number of pieces of mail of a specific subclass delivered by the Postal Service.

(d) Mr. Sellick's IOCS-based distribution key shares represent the shares of costs, by MODS pool, accounted for by the various mail subclasses.

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USPS/UPS-T1-3. Please refer to your testimony, UPS-T-1, at pages 30-36. Please also refer to USPS-T-15 at pages 52-53, especially lines 17-18 of page 52 and lines 7-8 of page 53.

a. Please confirm that you conducted an analysis of the relationship between TPF (or TPH, as appropriate) and FHP as a test of the "proportionality assumption" discussed by Dr. Bozzo. If you do not confirm, please explain the purpose of the analysis you present at pages 34-36 of your testimony.

b. Does Dr. Bozzo describe the "proportionality" assumption as pertaining to the relationship between piece handlings and subclass RPW volumes, or to the relationship between piece handlings and FHP volumes? Please explain the basis for your answer.

c. Please provide a detailed statement of your understanding of the distinction between RPW volume and FHP volume.

d. Have you conducted any analysis of the relationship between FHP volumes and RPW volumes? If so, please provide a detailed description of the methods and results of your analysis.

Response to USPS/UPS-T1-3.

(a) Confirmed.

(b) Dr. Bozzo describes the "proportionality" assumption as pertaining to the relationship between piece handlings and subclass RPW volumes, as explained on page 52, lines 17-18 of his testimony.

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(c) I understand that at a given point in time, mail processing and transportation plans provide a specific routing for each potential origin-destination combination. A particular piece of mail traveling from a specific origin to a specific destination may pass through multiple mail processing plants as it makes its way along this routing. This arrangement is described in the stylized example presented in USPS-T-16, pages 15-16. A single piece of mail, representing a unit increase in RPW volume, will generate a unit increase in FHP volume at each of the processing plants through which it passes and in which it undergoes sortation. The relationship between incremental RPW volume and incremental FHP volume will depend upon routing, and, for a given routing, the two will generally vary in direct proportion.

I understand that exceptions to direct proportionality between RPW volume and FHP volume may sometimes occur. A change in the geographic distribution of mail is likely to alter the relationship. Reconfiguration of the network involving the opening or closing of plants is also likely to alter the relationship. Sortation errors and misrouting of mail may increase the number of plants a particular piece of mail passes through, and thus changes in the frequency of these errors may also alter the relationship between RPW volume and FHP volume. Changes in worksharing can alter the relationship beween RPW volume and FHP.

Any departures from direct proportionality between FHP volume and RPW volume would have an equal or greater effect on the relationship between TPF and RPW volume.

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(d) No.

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USPS/UPS-T1-4. Please refer to your testimony, UPS-T-1, at page 62. You indicate in note 1 to the table that "[v]olume variability is defined as:

$$\frac{\partial \ln C}{\partial \ln FHP} = \frac{\partial \ln C}{\partial \ln TPH} \cdot \frac{\partial \ln TPH}{\partial \ln FHP}."$$

a. Does your equation omit a subscript (say, "i") indicating cost pool?

b. If your response to part (a) is affirmative, confirm that the equation from note 1 may be rewritten as:

$$\frac{\partial \ln C_i}{\partial \ln FHP_i} = \frac{\partial \ln C_i}{\partial \ln TPH_i} \cdot \frac{\partial \ln TPH_i}{\partial \ln FHP_i}.$$ If not, please provide a version of the equation that correctly specifies the omitted subscripts.

Response to USPS/UPS-T1-4.

(a) Yes. I was speaking in general terms, not necessarily with respect to an analysis based on cost pools.

(b) Table 9 on page 62 presents the results of two calculations. Results presented in the second column from the right reflect TPH/FHP elasticities calculated at the MODS pool level. For this calculation, the modification of the equation from note 1 presented in part (b) of this question is correct. Results presented in the rightmost column, however, reflect TPH/FHP elasticities calculated at the shapes level. For that calculation, the appropriate modification of the note 1 equation would be:

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$\frac{\partial \ln C_i}{\partial \ln FHP_i} = \frac{\partial \ln C_i}{\partial \ln TPH_i} \cdot \frac{\partial \ln TPH_j}{\partial \ln FHP_j}$, where the subscript *i* refers to MODS pool and the subscript *j* refers to the shape grouping of which MODS pool *i* is a part.

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USPS/UPS-T1-5. Please refer to your testimony, UPS-T-1, at page 74, lines 20-21. You state that "Postal Service witnesses have argued that increases in cost associated with growth in the number of addresses have no relevance to ratemaking." Please refer further to your testimony at page 75, lines 14-15, where you indicate that growth in the number of delivery points is "costly to accommodate."

a. Please provide detailed citations to the Postal Service testimony you reference in the statement from page 74 quoted above. If you can find none, what is the basis for the statement?

b. Do you believe that there are "increases in cost associated with growth in the number of addresses" for mail processing? If not, explain in detail the meaning of the statement from page 75 quoted above.

c. If there are "increases in cost associated with growth in the number of addresses," how are those costs causally attributable to a subclass of mail as volume-variable (or marginal cost)? Provide a detailed justification of your response.

d. If there are "increases in cost associated with growth in the number of addresses," how are those costs causally attributable to a subclass of mail as incremental cost? Provide a detailed justification of your response, including a reconciliation of your response with the discussion of incremental cost provided by witness Sappington in UPS-T-6.

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Response to USPS/UPS-T1-5.

(a) See USPS-T-15, pages 47-48, in which Dr. Bozzo discusses the distinction between network characteristics and volume. He states on page 47, lines 19-20, that "Volume and network characteristics interact in complicated ways, but volume does not cause network characteristics." Later on page 48, lines 16-18, after a lengthy discussion of the effects of network characteristics on costs, he concludes that "Such systematic productivity differences are clearly not driven by volume, but rather by non-volume network characteristics."

See also USPS-T-15, page 125, lines 13-16, in which Dr. Bozzo states that "The significance of the distinction between the volume and the network effect for postal costing is that *the deliveries elasticities, the contributions of the network to the costs of processing operations, are not causally attributable to the subclasses of mail."* (emphasis in the original).

See also USPS-T-16, page 5, lines 21-25, in which Mr. Degen states that "I identify some of the local cost-causing characteristics that will not change in response to a small sustained increase in volume. Some of these characteristics appear to be volume-related but are, in fact, driven by non-volume factors, particularly those pertaining to the delivery network served by each plant."

(b) Yes.

(c) As I discuss on page 75, lines 7-12, a portion of the volume growth experienced by the Postal Service will result from the creation of new households and

new businesses. These new households and businesses represent new delivery points. Associated with each delivery point will be a characteristic mix of mail. Accommodating the volumes associated with such new delivery points requires modification of the processing plan for each mailstream experiencing such growth in volume. Costs associated with these modifications are causally related to the volume growth caused by the creation of new households and businesses.

(d) See my response to part (c), above.

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USPS/UPS-T1-6. Refer to your analysis of the relationship between FHP and TPF (or TPH, as appropriate).

a. Confirm that a piece of mail may receive subsequent handlings in cost pools other than the cost pool in which it is recorded for FHP, e.g., pieces without a mailer applied barcode that are initially processed on OCR equipment and receive subsequent handlings on BCS equipment. Explain fully any answer other than an unconditional confirmation.

b. Does your analysis of the relationship between FHP and TPF account for the fact that the FHP count for a piece and subsequent TPF volume may appear in different cost pools? If so, please explain how.

Response to USPS/UPS-T1-6.

(a) Confirmed.

(b) Yes. My MODS pool level analysis of the relationship between FHP and TPF does not account directly for the fact that a particular piece of mail may be processed in multiple MODS pools. This is a weakness inherent in MODS-level analysis. It was for this reason that I also conducted analyses of the relationship between FHP and TPF at the shapes level, which, by aggregating cost pools by shape, reflects the fact that the FHP count for a piece and subsequent TPF volume may appear in different cost pools. See UPS-T-1, pages 37-38.

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USPS/UPS-T1-7. Please refer to your testimony at page 62 (Table 9).

(a) Please provide copies of all exhibits referenced in the notes to Table 9. If the referenced material is provided elsewhere in your testimony or workpapers, provide correct citations.

(b) Note 3 appears to refer erroneously to "Appendix 5." Please provide the correct reference.

(c) Please provide estimated standard errors for all quantities reported in Table 9, other than those obtained directly from Dr. Bozzo's testimony.

(d) Please describe fully the method used to compute the standard errors provided in response to part (c). If the method is described elsewhere in your testimony or workpapers, provide appropriate citations.

Response to USPS/UPS-T1-7.

(a) In note 3 on page 62, the reference to "Exhibit 9" should be replaced with "Table 8." In that same note, the reference to "Appendix 5" should be replaced with "Appendices E and F." In note 4 on page 62, the reference to "Exhibit 10" should be replaced with "Table 6." In note 5 on page 62, the reference to "Exhibit 11" should be replaced with "Table 7."

(b) See my response to USPS/UPS-T1-7(a), above.

(c) See the attached Table Prepared in Response to USPS/UPS-T1-7(c). In order to comply most efficiently with this request, I have recomputed volume variabilities using the procedures described in my response to (d), below. Because of the different

samples used, these variability estimates differ slightly from those presented in my testimony, but lead to identical conclusions. Although I have recomputed variabilities in a way that permits efficient computation of standard errors, I stand by my original testimony in this area.

(d) The corrections to Dr. Bozzo's volume variability ($a \equiv \frac{\partial \ln(Cost_i)}{\partial \ln(FHP_i)}$) for MODS group *i* are computed in two ways that correspond to the two different estimates presented in Table 9:

(1) The variability a_1 is defined as the product of the MODS variability of costs with respect to TPH/F ($b \equiv \frac{\partial \ln(Cost_i)}{\partial \ln(TPH/F_i)}$) and the MODS variability of TPH/F with respect to FHP ($d_1 \equiv \frac{\partial \ln(TPH/F_i)}{\partial \ln(FHP_i)}$).

(2) The variability a_2 is defined as the product of the MODS variability of costs with respect to TPH/F (*b*) and the shapes variability of TPH/F with respect to FHP ($d_2 \equiv \frac{\partial \ln(TPH/F_j)}{\partial \ln(FHP_j)}$), where *j* indexes the shape processed by MODS group *i*.

Thus, these variabilities can be expressed as:

(1') $a_1 = b \times d_1$, and

(2') $a_2 = b \times d_2$.

Let $\hat{b}$, $\hat{d}_1$, and $\hat{d}_2$ denote estimators for *b*, d_1, and d_2, respectively, with associated variances $V(\hat{b})$, $V(\hat{d}_1)$, and $V(\hat{d}_2)$. Estimates for *b*, d_1, and d_2 are presented in Table 9 of at page 62 of UPS-T-1. The associated standard errors for $\hat{b}$ (for all but

Parcels) are presented in UPS-Neels-WP-1 (UPS-T-1), in folder "Appendix – Analysis Program Files", subfolder "Replication.prg", file "Verifying Replication of Bozzo.xls" (electronic version), and in Appendix: Analysis Programs, B. Program and Log Files, "Verifying the Replication of Bozzo's Analysis Sample and Variability Estimates" (hardcopy version). The standard errors for $\hat{d}_1, \hat{d}_2$, and $\hat{b}$ for Parcels are presented in UPS-T-1, Tables 6 (page 36), 7 (page 38), and 8 (page 60), respectively.

Estimators for a_1 and a_2 are given by:

(1") $\hat{a}_1 = \hat{b} \times \hat{d}_1$, and

(2") $\hat{a}_2 = \hat{b} \times \hat{d}_2$

The associated variances are generally functions of $V(\hat{b})$, $V(\hat{d}_1)$, $V(\hat{d}_2)$, the covariance of $\hat{b}$ and $\hat{d}_1$, and the covariance of $\hat{b}$ and $\hat{d}_2$, denoted as $Cov(\hat{b}, \hat{d}_1)$ and $Cov(\hat{b}, \hat{d}_2)$. If the two parameters b and d_k, where k indexes the correction method, are estimated using the same analysis sample, $Cov(\hat{b}, \hat{d}_k) \neq 0$. Alternatively, if the two parameters are estimated using orthogonal or uncorrelated analysis samples, then $Cov(\hat{b}, \hat{d}_k) = 0$.

The results contained in UPS-T-1 present estimates of b and d_k that are constructed using essentially the same analysis samples. Thus, calculation of standard errors for $\hat{a}_1$ and $\hat{a}_2$ requires either: (1) joint estimation of b and d_k, which would then

permit construction of an estimate of Cov($\hat{b}$, $\hat{d}_k$), or (2) re-estimation of b and d_k using orthogonal analysis samples, which would render Cov($\hat{b}$, $\hat{d}_k$) = 0.

In order to avoid introduction of new joint estimation methods, I employ the latter approach. Using a random number generator that draws from the uniform distribution, I randomly partition the 321 facilities in the analysis sample into two unique sets of facilities. The data in the first set are referred to as Sample 1, and the data in the second set are referred to as Sample 2. Samples 1 and 2 are orthogonal by construction, under the maintained assumptions of USPS-T-15. I have included the data and programs used in these calculations along with information on how the sample was partitioned in library reference UPS-LR-2.

I estimate the parameter b for each of the groups in the table using Sample 1. Parameters d_k are estimated using Sample 2. These estimates along with their standard errors are presented in columns (2)-(4) of the attached Table Prepared in Response to USPS/UPS-T1-7(c). I have included the programs used to generate these results in library reference UPS-LR-2.

Estimates for a_1 and a_2 are presented in columns (5) and (6) of the attached Table Prepared in Response to USPS/UPS-T1-7(c). I calculate the variance of $\hat{a}_1$ and $\hat{a}_2$ using a Taylor series approximation around the product of the estimated values of b and d. The associated standard errors, presented in parentheses below the estimates, are thus computed as:

$$se(\hat{a}_k) = ((\hat{d}_k \times se(\hat{b}))^2 + ((\hat{d}_k \times se(\hat{b}))^2)^{\frac{1}{2}}$$

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The T-test statistics presented in columns (7) and (8) of the attached Table Prepared in Response to USPS/UPS-T1-7(c) show that using the MODS-level adjustment, the resulting volume variabilities are statistically different from Dr. Bozzo's variabilities in column (2) in all but three instances. Using the shapes-level adjustment, the resulting variabilities are statistically different in all but one instance.

Table Prepared in Response to USPS/UPS-T1-7(c)

MODS-Level Estimates of the Elasticity of Labor Costs with Respect to First Handled Pieces

Group	Bozzo's Variability of Costs w.r.t. TPH	Re-estimation of Bozzo's Variability of Costs w.r.t. TPH using Sample 1	MODS Level Variability of TPH w.r.t. FHP using Sample 2	Shapes Level Variability of TPH w.r.t. FHP using Sample 2	Volume Variability With MODS Level Correction	Volume Variability With Shapes Level Correction	T-test Statistic for Ho: Volume Variability (col(2)) = TPH/F Variability (col(5))	T-test Statistic for Ho: Volume Variability (col(2)) = TPH/F Variability (col(6))
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OCR	0.751	0.798	1.623	1.632	1.295	1.302	5.264	5.361
std error	(0.038)	(0.054)	(0.044)	(0.041)	(0.094)	(0.094)		
sample size	5088	2663	2405	2236				
LSM	0.955	0.966	1.029	1.632	0.994	1.577	0.559	9.673
std error	(0.021)	(0.030)	(0.041)	(0.041)	(0.050)	(0.063)		
sample size	3894	1959	1882	2236				
BCS	0.895	0.817	1.721	1.632	1.406	1.333	7.685	7.170
std error	(0.030)	(0.039)	(0.045)	(0.041)	(0.077)	(0.072)		
sample size	5390	2773	2617	2236				
Manual Letters	0.735	0.788	1.238	1.632	0.976	1.286	4.322	7.918
std error	(0.024)	(0.033)	(0.019)	(0.041)	(0.043)	(0.063)		
sample size	5499	2816	2685	2236				
FSM	0.817	0.809	1.663	1.344	1.345	1.087	8.473	5.893
std error	(0.026)	(0.033)	(0.039)	(0.020)	(0.063)	(0.047)		
sample size	4357	2295	2057	2272				
Manual Flats	0.772	0.776	1.018	1.344	0.790	1.043	0.323	4.559
std error	(0.027)	(0.042)	(0.008)	(0.020)	(0.043)	(0.059)		
sample size	4879	2567	2312	2272				
Parcels[3]	0.750	0.700	1.613	1.613	1.129	1.129	3.894	3.894
std error	(0.034)	(0.047)	(0.114)	(0.114)	(0.110)	(0.110)		
sample size	3651	1954	1737	1737				
Priority	0.522	0.573	1.015	1.015	0.582	0.582	0.197	0.197
std error	(0.025)	(0.043)	(0.004)	(0.004)	(0.044)	(0.044)		
sample size	3240	1612	1630	1630				

Notes and Sources:

1. Volume variability is defined as :

$$\frac{\partial \ln C}{\partial \ln FHP} = \frac{\partial \ln C}{\partial \ln TPH} \times \frac{\partial \ln TPH}{\partial \ln FHP}$$

2. Bozzo's variabilities from USPS-T-15, pp. 119-120, have been re-estimated using Sample 1 sites.

3. For Parcels, the elasticity of costs with respect to (w.r.t.) TPH was estimated by combining the SPBS and Manual Parcels MODS groups, as described in the text of my report and presented in UPS-T-1, Table 8. These variabilities have been re-estimated using Sample 2 sites.

4. The MODS-level variability of TPH w.r.t. FHP, from Table 6 in UPS-T-1, have been re-estimated using Sample 2 sites.

5. The Shapes-level variability of TPH w.r.t. FHP, from Table 7 in UPS-T-1, have been re-estimated using Sample 2 sites. Letter variability of TPH w.r.t. FHP applied to MODS groups OCR, LSM, BCS, and Manual Letters. Similarly, Flats variabilities applied to Manual Flats and FSM.

6. Because the regression equations used to estimate the volume variability and the variability of TPH w.r.t. FHP rely on different sets of variables, the usable samples for the two sub-sample regressions do not always sum to the full usable sample.

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USPS/UPS-T1-8. Please refer to your testimony on page 62 (Table 9).

(a) Confirm that the number (1.597) reported in the OCR line of Table 9 in the column labeled "MODS Level Variability of TPH w.r.t. FHP" is an estimate of the elasticity of OCR TPH with respect to OCR FHP. If you do not confirm, please provide the interpretation you believe to be correct.

(b) Confirm that the number (2.062) reported in the OCR line of Table 9 in the column labeled "Shapes Level Variability of TPH w.r.t. FHP" is an estimate of the elasticity of total TPH for letter-shape operations with respect to total FHP for letter-shape operations. If you do not confirm, please provide the interpretation you believe to be correct.

(c) Confirm that the numbers reported in the lines of Table 9 other than OCR, in the column labeled "MODS Level Variability of TPH w.r.t. FHP," are estimates of the elasticity of TPH in the specified "MODS Group" with respect to FHP in the specified "MODS Group." If you do not confirm, please provide the interpretation you believe to be correct.

(d) Confirm that the numbers reported in the lines of Table 9 other than OCR, in the column labeled "Shapes Level Variability of TPH w.r.t. FHP," are estimates of the elasticity of total TPH for the shape of mail corresponding to the specified "MODS Group" with respect to total FHP for shape of mail corresponding to the specified "MODS Group." If you do not confirm, please provide the interpretation you believe to be correct.

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Response to USPS/UPS-T1-8.

(a) Confirmed.

(b) Confirmed.

(c) Confirmed.

(d) Confirmed.

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USPS/UPS-T1-9. Please refer to your testimony at page 26, lines 7-9. You state, referring to Dr. Bozzo's response to UPS/USPS-T15-13 (Tr. 15/6387-6388), "For Site #6 in particular, Dr. Bozzo indicates that the gaps in the data series corresponded to periods where the data for the SPBS and Manual Parcels MODS activities were commingled and reported together as data for the SPBS MODS group."

(a) Confirm that the "data series" for site #6 addressed in UPS/USPS-T15-13 are the TPH series for manual parcels and manual Priority Mail operation groups. If you do not confirm, please explain.

(b) Confirm that in response to oral examination by counsel for UPS, Dr. Bozzo indicated that he used the term "commingled" to mean "that site [#6] had handled manual and SPBS parcels together up to a point prior to separating them according to the mail processing technology that was used to sort them" (Tr. 15/6431, lines 2-5).

(c) Where did Dr. Bozzo state, either in the cited response to UPS/USPS-T15-13, or in response to oral examination at Tr. 15/6430-6431, that "data for the SPBS and Manual Parcels MODS activities were commingled and reported together as data for the SPBS MODS group"? If Dr. Bozzo did not make this statement, please so indicate.

Response to USPS/UPS-T1-9.

(a) Confirmed.

(b) Dr. Bozzo's response at Tr. 15/6431, lines 2-5, addressed the following question posed by counsel for UPS:

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"Does that mean that manual parcels and SPBS parcels were handled together in the same operation, or let me just [ask] you what did you mean by commingled?" (Tr. 15/6430, line 24 - Tr. 15/6431, line 1).

The question as asked refers not to the logging of data, but rather to the handling of parcels. Dr. Bozzo's response appears to address this operational question, and indicates that until the introduction of new technology created separate processing streams, all parcels were handled together in the same operation.

I confirm that the question quotes Tr. 15/6431, lines 2-5, accurately.

(c) In his response to UPS/USPS-T15-13; Dr. Bozzo stated that "the intermittent reporting of manual parcel piece handlings may reflect periods in which manual and SPBS parcels were commingled" (Tr. 15/6387). His response to oral cross-examination by counsel for UPS raises the question of whether he was referring to the commingling of data, or to the commingling of parcels in a single operation. At the time I prepared my Direct Testimony, I interpreted his response to refer to the commingling of data, and I still believe that this is the only interpretation that makes sense.

As Dr. Bozzo himself points out in his response to UPS/USPS-T15-13, during the time from period 294 through period 295 when manual parcel TPH for site #6 are reported as zero, positive manual parcel work hours are reported. The table below, which confirms Dr. Bozzo's response, shows TPH/F and work hours for manual parcels and SPBS for site #6. Based on these data, it appears that site #6 introduced SPBS technology in period 194, after which time it reports positive piece handlings and work

hours for its SPBS operation. From periods 294 through 295 and from 296 through 397, site #6 reports zero piece handlings for manual parcels but positive work hours for manual parcels. The fact that work hours are reported separately for manual parcels and SPBS during these periods clearly indicates that both operations were up and running, and that it is the TPH ***data*** for the two operations that are commingled.

MODS Pieces and Labor Hours for Site # 6				
Quarter	Manual Parcels		SPBS	
	TPH	HRS	TPF	HRS
193	181	3473	0	0
293	181	3820	0	0
393	188	3153	0	0
493	157	3370	0	0
194	138	4316	1014	4894
294	0	3603	1860	14191
394	0	3282	1933	12854
494	0	2721	2068	13423
195	0	3157	3162	16031
295	0	2418	3276	16918
395	20	1788	3039	12513
495	96	1454	3374	9641
196	109	1787	3658	11522
296	0	854	3302	8621
396	0	1047	2971	6894
496	0	1586	2309	7638
197	0	1800	3380	9570
297	0	1162	2699	7894
397	0	950	3159	9369
497	724	307	3114	9278
198	445	16	3491	10228
298	2516	72	2475	6523
398	1600	11	3016	8072
498	1321	0	2627	9581

Parcels entering a processing plant become either manual parcels or SPBS parcels by virtue of their characteristics and how and where they are processed. For

the most part, machinable parcels are processed at BMCs, using primary and secondary parcel sorters and small parcel and bundle sorters (USPS-T-10, pp. 19-20). Loose parcels, parcels in 5-digit sacks, non-machinable outside parcels, and First-Class odd shapes are sorted manually (USPS-T-16, p. 44, lines 7-9); these parcels either are not or cannot be processed in the SPBS operation. In other words, if all parcels were processed together in the SPBS operation, as the TPH data suggests, they would all by definition be SPBS parcels, and it would not make sense to talk of "commingling" manual parcels and SPBS parcels in SPBS operations.

Webster's Revised Unabridged Dictionary defines "commingle" as: "To mingle together; to mix in one mass." Thus, I expected to find the manual parcel and SPBS THP/F data for periods 294 through 295 in site #6 to be reported together "in one mass." These data were clearly not reported as manual parcel TPH/F, since those values appear as zeros in Dr. Bozzo's data set. The other logical place where the commingled data could have appeared – namely, the SPBS TPH/F data series – held positive values. I assumed that this represented the commingled manual parcel and SPBS data, and that still seems to be the most likely situation. However, I cannot exclude the possibility that the numbers shown as SPBS TPH/F for periods 294 through 295 in site #6 actually represent something completely different, and that the commingled parcel TPH/F data appear elsewhere, in some illogical place, as the result of data reporting errors.

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USPS/UPS-T1-10. Please refer to your testimony at page 24, line 15, to page 25, line 2. Also refer to Table 4 on page 25.

(a) Confirm that the data in Table 4 do not reflect the errata to USPS-T-15 filed on January 25, 2000. If you do not confirm, please explain.

(b) Confirm that Table 4, corrected to reflect the errata to USPS-T-15, filed on January 25, 2000, would read as follows:

Table 4
MODS Data Quality

MODS Group	Non-Missing	Threshold	Threshold and Productivity	% of Observations Exhibiting Gross Data Errors
BCS	6885	6883	6780	1.53%
OCR	6644	6639	6495	2.24%
FSM	5442	5442	5424	0.33%
LSM	5156	5150	5127	0.56%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Manual Letters	6914	6914	6824	1.30%
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
SBPS	2244	2239	2213	1.38%
Metered Cancellations	6746	6718	6599	2.18%

Notes and Sources:
1. Data from USPS-T-15, p. 107 (revised 1/25/00).
2. Because Dr. Bozzo records both true missing values and bad data as zeros, these data underestimate the percent of gross errors.

If you do not confirm, explain fully.

(c) Confirm that the percentages of observations you report for the manual flats, manual parcels, and manual Priority Mail operations at page 24 (lines 17-18) of UPS-T-1 are inconsistent with the corrected version of Table 4 from part (b). If you do not confirm, please explain fully.

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(d) Confirm that to be consistent with the corrected version of Table 4 from part (b), the percentages reported at page 24 (lines 17-18) of UPS-T-1 for manual flats, manual parcels and manual Priority Mail should be (respectively) 7 percent, 19 percent, and 13 percent, when rounded to the nearest percentage point. If you do not confirm, please explain fully.

Response to USPS/UPS-T1-10.

(a) I am unaware of errata filed on January 25, 2000. The data in the table in part (b) of this interrogatory appear to reflect the errata to USPS-T-15 filed on January 28, 2000. The errata filed on January 28, 2000, contain revised versions of Tables 3, 6, and 10 for USPS-T-15. As best as I can determine, those errata do not contain any accompanying programs or description of the changes implemented. The notice of those errata merely states, "All changes are peripheral to the proposed variabilities presented in the testimony."

(b) The data in the table in this interrogatory reflect the January 28, 2000, errata. However, I note that these data do not reflect the later errata to USPS-T-15 filed on March 22, 2000, as part of Dr. Bozzo's response to UPS/USPS-T15-9 (Tr. 15/6381-86).

My original implementation of the sample selection methodology described in USPS-T-15 produced the data sample shown in the errata to USPS-T-15 filed on March 22, 2000. However, in an effort to replicate Dr. Bozzo's analysis results, I expended considerable resources to isolate Dr. Bozzo's deviations from his described methodology to generate the results in the tables originally contained in his testimony.

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At the technical conference with Dr. Bozzo held on March 1, 2000, UPS asked a number of questions about Dr. Bozzo's implementation of his sample selection scrubs. However, UPS was asked to submit these questions in interrogatories, which were submitted on March 8, 2000 as interrogatories UPS/USPS-T15-9 through 17. On March 22, 2000, Dr. Bozzo conceded in his answer to interrogatory UPS/USPS-T15-9 that certain "observations were inadvertently omitted" from his analysis and that certain observations with "missing or invalid NWRS wage" data were included in the summary of his regression samples. Tr. 15/6381. Recognizing these oversights, he presented a corrected version of the data in that interrogatory answer.

Having already generated the correct analysis sample and then reverse engineered Dr. Bozzo's analysis sample, I was in the middle of extensions of the volume variability calculations when the new errata were filed. Given the time constraints imposed by the deadline for filing of intervenor testimony and the nature of Dr. Bozzo's data revisions, I judged that the expenditure of time and resources to re-generate the tables and the extensions of the variability calculations presented in UPS-T-1 using Dr. Bozzo's revised data was unwise, especially in view of Dr. Bozzo's assertion that those changes had no substantive effect on the results of his study.

In response to this interrogatory, however, I have prepared the attached Table Prepared in Response to USPS/UPS-T1-10(b), which reflects the errata to USPS-T-15 filed on March 22, 2000. This table reflects the sample sizes (in columns (1), (2), and (3)) which emerge from implementation of the sample selection criteria described in

USPS-T-15. Column (4) shows the percent of Dr. Bozzo's "non-missing" observations exhibiting gross data errors using the threshold and productivity scrubs.

As I stated in note 2 to my Table 4 at page 25 of UPS-T-1, these figures understate the extent of the error in the MODS data because they fail to account for gaps in reporting. Dr. Bozzo calculates error rates by dividing the number of observations excluded by his threshold and productivity checks by the number of observations with complete data. Gaps in reporting are inappropriately excluded from both the numerator and the denominator of his calculations.

If all activities were present in all facilities in all periods, the number of potential observations for Dr. Bozzo's analyses would equal 7,704 (321 sites times 24 quarters). Potential sample sizes are generally less than this, however, because some activities are not present in all facilities. Some activities initiate operations at particular sites after the start of Dr. Bozzo's sample period, others terminate before the end of the sample period. Excluding cases where the activity is truly absent yields the maximum possible sample for Dr. Bozzo's analysis, and the appropriate denominator for calculating error rates. Missing values for non-MODS variables (e.g., wages or capital index) sometimes reduce the size of this potential sample. To focus on the error rate for the MODS data, I exclude observations with missing values for non-MODS variables from both the numerator and the denominator of the error rate calculation. Following Dr. Bozzo, I also exclude the observation for the first quarter of 1993 in each site.

The numerator for the MODS gross error rate calculations should include not just observations deleted by the productivity and/or threshold calculations, but also

observations that fail to record either TPH/F or work hours when the activity is present. Thus, in the Table Prepared in Response to USPS/UPS-T1-10(b), I add to the threshold and productivity counts shown in column (3) observations with complete non-MODS data and either {TPH/F > 0 and work hours ≤ 0}, {TPH/F ≤ 0 and work hours > 0}, or {TPH/F ≤ 0, work hours ≤ 0, and TPH/F ≤ 0 is intermittent ("gaps", as defined on page 25 of UPS-T-1)}. Observations in each of these three sets should be taken into account as data problems in the overall measure of MODS data quality.

Column (5) of the attached Table Prepared in Response to USPS/UPS-T1-10(b), shows the percentage of observations exhibiting gross data errors after giving proper treatment to non-positive values for the MODS data series TPH and work hours. This column includes the observations that would have been "non-missing" but for poor quality MODS data for either TPH/F or work hours, and provides a count of the number of the total number of gross data errors, including those unaccounted for by Dr. Bozzo's calculation. All of these observations fail the threshold and productivity scrubs. The percent of observations exhibiting gross data errors shown in column (5) of the attached Table is computed as the fraction of non-missing observations that include both non-missing observations that fail the threshold and productivity scrubs, as well as those identified by the selection criteria described in the paragraph above.

I note that Table 4 in UPS-T-1 at page 25, the attached Table Prepared in Response to USPS/UPS-T1-10(b), and the version of Table 4 presented by the Postal Service in this interrogatory *all* suggest that the MODS data series for SPBS and

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Manual Parcels exhibit gross data errors that exceed acceptable levels, as defined by Dr. Bozzo himself in USPS-T-15.

I respond to the remaining parts of the question below in light of the attached Table Prepared in Response to USPS/UPS-T1-10(b).

(c) Confirmed, except that the version of Table 4 presented by the Postal Service in part (b) of this interrogatory is not "the" corrected version of Table 4, since it does not reflect the later corrections made by Dr. Bozzo in response to UPS/USPS-T15-9 (Tr. 15/6381-86). See my response to USPS/UPS-T1-10(b), above.

(d) Confirmed that the percentages stated reflect the (incorrect) data shown in the version of Table 4 presented by the Postal Service in part (b) of this interrogatory. It would be more accurate to replace the percentage of observations exhibiting gross data errors reported at page 24 (lines 17-18) of UPS-T-1 for manual flats, manual parcels, and manual Priority Mail with 7 percent, 28 percent, and 22 percent, for the reasons given in (b), above. It is also noteworthy that the percentage of observations exhibiting gross data errors for LSM and SPBS should be replaced with 7 percent and 8 percent, respectively.

Table Prepared in Response to USPS/UPS-T1-10(b)

MODS Group	Non-Missing	Threshold	Threshold and Productivity	% of Observations Exhibiting Gross Data Errors	
				Ignoring Non-Positive MODS Data	Accounting for Non-Positive MODS data
	(1)	(2)	(3)	(4)	(5)
OCR	6642	6637	6493	2.24%	3.19%
LSM	5155	5149	5126	0.56%	6.94%
BCS	6882	6880	6777	1.53%	1.54%
FSM	5441	5441	5423	0.33%	1.00%
Manual Flats	6910	6910	6416	7.15%	7.16%
Manual Letters	6910	6910	6820	1.30%	1.32%
SPBS	2241	2236	2210	1.38%	8.45%
Manual Parcels	5831	5621	4709	19.24%	28.07%
Priority	5713	5640	4992	12.62%	22.04%

Notes and Sources:

1. Data from USPS-T-15 (revised 3/22/00), Tr. 15/6383, and Reg9398.xls in USPS-LR-I-107.
2. "Accounting for Bad MODS data" column shows the percentage of observations exhibiting gross data errors when properly accounting for true missing value and bad TPH or work hours data.
3. Column (5) counts as bad data observations with complete non-MODS data, but non-positive values for either TPH or HRS.

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USPS/UPS-T1-11. Please refer to the analysis you describe in UPS-T-1 at pages 63-71 (line 10).

(a) Provide, using mathematical notation (see, e.g., USPS-T-15 at page 118, line 4), the estimating equation for each reported "volume-variability" result in Table 11 and Table 12.

(b) Did you explore any alternative model(s) or specification(s) to those provided in response to part (a)? If so, for each alternative model or specification, describe the alternative model or specification, indicate the difference(s) between the alternative and the corresponding model from part (a), and provide a statement of the reasons for rejecting that alternative.

Response to USPS/UPS-T1-11.

(a) As requested, I re-state the estimating equation, separately for Tables 11 and 12.

This estimating equation for column (1), Table 11 at page 68 of UPS-T-1, can be written as:

$$\ln(MPCH) = \alpha_0 + \alpha_1 \ln(LHWSHRAV) + \varepsilon_1$$

where MPCH is GDP-deflator deflated accrued costs for mail processing clerks and mailhandlers, LHWSHRAV is labor hours and workshare-adjusted volume, with lamda = 0.6, 0.7, or 0.8, and ε_1 is the stochastic error term.

The estimating equation for column (2), Table 11, can be written as:

$$\ln(MPCHOM) = \alpha_0 + \alpha_1 \ln(LHWSHRAV) + \varepsilon_2$$

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where MPCHOM is GDP deflator deflated accrued costs for mail processing clerks, handlers, and operating equipment maintenance, and ε_2 is the stochastic error term.

The estimating equation for column (3), Table 11 can be written as:

$$\ln(MPCHSOM) = \alpha_0 + \alpha_1 \ln(LHWSHRAV) + \varepsilon_3$$

where MPCHSOM is GDP deflator deflated accrued costs for mail processing clerks, handlers, supervisors, and operating equipment maintenance, and ε_3 is the stochastic error term.

The estimating equation for column (1), Table 12 at page 70 of UPS-T-1 can be written as

$$\ln(MPCH) = \alpha_0 + \alpha_1 \ln \left\{ \left(\frac{Laborwt_{first}}{Vfirst_{98} - \lambda \times Wfirst_{98}} \right) \times (Vfirst - \lambda Wfirst) \right.$$
$$+ \left(\frac{Laborwt_{priority}}{Vpriority_{98} - \lambda \times Wpriority_{98}} \right) \times (Vpriority - \lambda Wpriority)$$
$$+ \left(\frac{Laborwt_{express}}{V\,express_{98} - \lambda \times W\,express_{98}} \right) \times (V\,express - \lambda W\,express)$$
$$+ \left(\frac{Laborwt_{periodical}}{Vperiodical_{98} - \lambda \times Wperiodical_{98}} \right) \times (Vperiodical - \lambda Wperiodical)$$
$$\left. + \left(\frac{Laborwt_{stda}}{Vstda_{98} - \lambda \times Wstda_{98}} \right) \times (Vstda - \lambda Wstda) + \left(\frac{Laborwt_{stdb}}{Vstdb_{98} - \lambda \times Wstdb_{98}} \right) \times (Vstdb - \lambda Wstdb) \right\} + \varepsilon_1$$

where

- MPCH is the GDP-deflator deflated accrued costs for mail processing clerks and mailhandlers,
- $LABORWT_{first}$ is the share of MODS labor hours in Reg9398.xls processing First Class Mail,
- Vfirst is the RPW volume for First Class Mail,

- Wfirst is the workshare volume for First Class Mail,
- $Vfirst_{98}$ is the RPW volume for First Class Mail in 1998,
- $Wfirst_{98}$ is the workshare volume for First Class Mail in 1998,
- $LABORWT_{priority}$ is the share of MODS labor hours in Reg9398.xls processing Priority Mail,
- Vpriority is the RPW volume for Priority Mail,
- Wpriority is the workshare volume for Priority Mail,
- $Vpriority_{98}$ is the RPW volume for Priority Mail in 1998,
- $Wpriority_{98}$ is the workshare volume for Priority Mail in 1998,
- $LABORWT_{express}$ is the share of MODS labor hours in Reg9398.xls processing Express Mail,
- Vexpress is the RPW volume for Express Mail,
- Wexpress is the workshare volume for Express Mail,
- $Vexpress_{98}$ is the RPW volume for Express Mail in 1998,
- $Wexpress_{98}$ is the workshare volume for Express Mail in 1998,
- $LABORWT_{periodical}$ is the share of MODS labor hours in Reg9398.xls processing Periodicals mail,
- Vperiodical is the RPW volume for Periodicals mail,
- Wperiodical is the workshare volume for Periodicals mail,
- $Vperiodical_{98}$ is the RPW volume for Periodicals mail in 1998,
- $Wperiodical_{98}$ is the workshare volume for Periodicals mail in 1998,

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- $LABORWT_{stda}$ is the share of MODS labor hours in Reg9398.xls processing Standard A mail,
- Vstda is the RPW volume for Standard A mail,
- Wstda is the workshare volume for Standard A mail,
- $Vstda_{98}$ is the RPW volume for Standard A mail in 1998,
- $Wstda_{98}$ is the workshare volume for Standard A mail in 1998,
- $LABORWT_{stdb}$ is the share of MODS labor hours in Reg9398.xls processing Standard B mail,
- Vstdb is the RPW volume for Standard B mail,
- Wstdb is the workshare volume for Standard B mail,
- $Vstdb_{98}$ is the RPW volume for Standard B mail in 1998,
- $Wstdb_{98}$ is the workshare volume for Standard B mail in 1998, and
- ε_1 is the stochastic error term.

Similarly, the estimating equations for column (2) and (3) of Table 12 can be written as:

$$\ln(MPCHOM) = \alpha_0 + \alpha_1 \ln\left\{\left(\frac{Laborwt_{first}}{Vfirst_{98} - \lambda \times Wfirst_{98}}\right) \times (Vfirst - \lambda Wfirst) + \left(\frac{Laborwt_{priority}}{Vpriority_{98} - \lambda \times Wpriority_{98}}\right) \times (Vpriority - \lambda Wpriority) + \left(\frac{Laborwt_{express}}{V express_{98} - \lambda \times W express_{98}}\right) \times (V express - \lambda W express) + \left(\frac{Laborwt_{periodical}}{Vperiodical_{98} - \lambda \times Wperiodical_{98}}\right) \times (Vperiodical - \lambda Wperiodical) + \left(\frac{Laborwt_{stda}}{Vstda_{98} - \lambda \times Wstda_{98}}\right) \times (Vstda - \lambda Wstda) + \left(\frac{Laborwt_{stdb}}{Vstdb_{98} - \lambda \times Wstdb_{98}}\right) \times (Vstdb - \lambda Wstdb)\right\} + \varepsilon_2$$

and

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$$\ln(MPCHSOM) = \alpha_0 + \alpha_1 \ln\left\{\left(\frac{Laborwt_{first}}{Vfirst_{98} - \lambda \times Wfirst_{98}}\right) \times (Vfirst - \lambda Wfirst) + \left(\frac{Laborwt_{priority}}{Vpriority_{98} - \lambda \times Wpriority_{98}}\right) \times (Vpriority - \lambda Wpriority) + \left(\frac{Laborwt_{express}}{Vexpress_{98} - \lambda \times Wexpress_{98}}\right) \times (Vexpress - \lambda Wexpress) + \left(\frac{Laborwt_{periodical}}{Vperiodical_{98} - \lambda \times Wperiodical_{98}}\right) \times (Vperiodical - \lambda Wperiodical) + \left(\frac{Laborwt_{stda}}{Vstda_{98} - \lambda \times Wstda_{98}}\right) \times (Vstda - \lambda Wstda) + \left(\frac{Laborwt_{stdb}}{Vstdb_{98} - \lambda \times Wstdb_{98}}\right) \times (Vstdb - \lambda Wstdb)\right\} + \varepsilon_3$$

respectively, where

- MPCHOM is the GDP-deflator deflated accrued costs for mail processing clerks, mailhandlers, and operating equipment maintenance,
- MPCHSOM is the GDP-deflator deflated accrued costs for mail processing clerks, mailhandlers, supervisors, and operating equipment maintenance, and
- ε_2 and ε_3 are the stochastic error terms.

(b) I explored three alternatives to the model specification described above. The first involved the use of alternative indices to adjust for the effects of inflation. As I describe in footnote 43 on page 65 of my testimony, I selected the GDP deflator because of all the indices, it most closely tracked the available data on wage and salary costs per hour for the Postal Service. It also came the closest of all the indices to direct proportionality with average wage and salary cost per hour.

The second set of alternative specifications closely resembled the model specification set forth above. They differed, however, in that they took the natural logarithm of nominal costs as the dependent variable, and included the log of the inflation index as an explanatory variable. These alternatives included the specification

shown above as a special case. I rejected these alternative specifications because I had strong a priori reasons to expect an estimated coefficient of one for the inflation index variable, and did not see a need to waste a degree of freedom in confirming those reasons.

In early work I explored specifications that used three alternative ways of weighting volumes by class, and that failed to include adjustments for changes in worksharing volume. I computed weights by calculating by class, alternatively, base year revenue per piece, pounds per piece, and incremental labor cost per piece. I rejected the revenue-based weights because of concerns that I might simply be building into the model the effects of past Commission decisions rather than measuring the extent of worksharing. I rejected the weight-based weights because of doubts as to whether average weight per piece for a mail class adequately reflects the per piece mail processing costs associated with a class. The labor cost weights were derived from the testimony of Postal Service witness Smith in this proceeding, and reflected the Postal Service's volume variabilities and distribution keys. As a result, these weights introduced an element of circularity into the analysis that caused me to reject them. Finally, I rejected specifications that did not control for worksharing, since changes in worksharing appear to be an important factor affecting the relationship between volume and cost over the period covered by the data.

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USPS/UPS-T1-12. For each reported "volume-variability" result in Table 11 and Table 12, please provide the data actually employed in the corresponding regression (i.e., after any transformations performed in program volume.prg in UPS-Neels-WP-1). Please provide the data in Microsoft Excel spreadsheet format, and include column labels consistent with the response to USPS/UPS-T1-11(a).

Response to USPS/UPS-T1-12.

Data used to produce the Table 11 and 12 results at pages 68 and 70 of UPS-T-1 are contained in UPS-Neels-WP-1 (UPS-T-1), in files Volume.xls (contained in the directory labeled "Appendix - Source Data", subdirectory "Volume") and Laborwt.dat and Laborwt.dht (shown in Appendix H of UPS-T-1, page H-26, and contained in the directory labeled "Appendix – Construction of Analysis Data", subdirectory "Transition.prg", subdirectory "Laborwt - Gauss (Output Data)"). See "Overview of Analysis Programs.xls" contained in the subdirectory labeled "Appendix – Analysis Program Files" in the electronic version of UPS-Neels-WP-1 (UPS-T-1).

As requested, the transformed data used to produce the Table 11 results are included in library reference UPS-LR-3, in the subdirectory marked "data for table 11 in response to USPS/UPS-T1-12." This subdirectory contains three Excel spreadsheets. The file labeled "data with lamda=0.8.xls" contains data used to generate the results shown in the first (horizontal) panel of Table 11, marked "Work Share Parameter = 0.8." The file labeled "data with lamda=0.7.xls" contains data used to generate the results shown in the second (horizontal) panel of Table 11, marked "Work Share Parameter =

0.7." The file labeled "data with lamda=0.6.xls" contains data used to generate the results shown in the third (horizontal) panel of Table 11, marked "Work Share Parameter = 0.6."

Similarly, transformed data used to generate the Table 12 results are contained in the subdirectory labeled "data for table 12 in response to USPS/UPS-T1-12." (Note, however, that Table 12 data can readily be used to generate Table 11 results). This subdirectory contains two files. The first file, called "volume2.xls," is a modified version of Volume.xls. The modifications are that the cost segment data have been deflated by the GDP deflator, the workshare data have been aggregated by class, and non-essential variables (such as the CPI) have been removed. Further simplifications are not possible because the workshare parameter is estimated along with the other model parameters using nonlinear least squares for the model specified on page 66, line 12, of UPS-T-1 and restated in response to USPS/UPS-T1-11(a). The other file in library reference UPS-LR-3, "Laborwt.xls", contains the term "laborwt" shown in the estimating equation for Table 12.

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USPS/UPS-T1-13. Please refer to your testimony, UPS-T-1, at page 63, lines 5-9. You state that to "capture the effects of structural changes in the underlying technology and organizational design of the postal system, I analyze the effects of mail volume on work hours using aggregate, system-level time series data on volumes and mail processing costs. These aggregate data, by their very nature, automatically reflect net changes in productivity and efficiency from system-wide structural changes."

a. With respect to your statement that "[t]hese aggregate data... automatically reflect net changes in productivity and efficiency from system-wide structural changes," please confirm that "[t]hese aggregate data" refers to the cost data.

b. If your response to part (a) does not confirm, please explain how the aggregate volume data you use in the analysis reported in Table 11 and Table 12 of UPS-T-1 purport to capture changes in any factor explaining mail processing cost other than mail volume. As necessary, resolve any inconsistencies between your response and your apparent use of fixed (FY98) class weights w_j and a fixed worksharing parameter λ to construct your volume index, as described on page 66 of UPS-T-1.

c. Please confirm that if your aggregate time series analysis excludes relevant explanatory variables other than mail volume, the "volume-variability" results you present in Table 11 and Table 12 of UPS-T-1 will be biased and/or inconsistent except in the special case that volume and the excluded variables are orthogonal. If you do not confirm, please resolve the inconsistency between your answer and standard econometric theory (cf., e.g., Proposition 9 at pages 39-40 of Peter Schmidt's *Econometrics*).

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Response to USPS/UPS-T1-13.

(a) I do not confirm. The aggregate data to which I refer include cost, work sharing and volume data.

(b) As I explain on pages 4-18 of UPS-T-1, the Postal Service responds to changes in mail volume in a variety of ways, both facility-wide and system-wide. By limiting the analysis to the plant and MODS-level, the very structure of Dr. Bozzo's approach ignores the bulk of these effects. Since Dr. Bozzo estimates variabilities conditional on the activity being present, he ignores decisions to install new processing activities at a plant. Because he uses data for a fixed panel of plants, Dr. Bozzo ignores the effects of plant openings, closings, expansions, and modifications.

The aggregate analysis presented on pages 63-71 of UPS-T-1 encompasses the overall effect of all of these changes. This analysis of volume variabilities employs both aggregate cost data and aggregate volume data. In using aggregate volume data, I deliberately remove the distinction between mail processed in different sorting operations, with different processing technologies, across different processing facilities. These distinctions reflect the decisions of the Postal Service concerning:

- work load allocation across MODS groups, as discussed on pages 21-23, and 57 of UPS-T-1;
- automation or mechanization in mail sortation, as discussed on pages 5-8 and 11-15 of UPS-T-1;
- changes in activity mix over time, as described on pages 9-11 of UPS-T-1; and

construction, expansion, and modification of existing mail processing plants, as discussed on pages 16-18 of UPS-T-1.

These decisions are a subset of "system-wide structural changes" to which I refer on page 63, lines 5-9, of my testimony. They do not belong in the regression model without explicit consideration of their effects on parameter estimation.

Furthermore, both aggregate cost data and aggregate volume data are required to "capture the effects of structural changes in the underlying technology and organizational design of the postal system." Indeed, as the passage quoted in USPS/UPS-T1-13(a) affirms, the aggregate cost data intrinsically reflect net changes in productivity and efficiency from all Postal Service responses to changes in mail volume. Only when aggregate cost data are used in conjunction with aggregate volume data can one take into account the "net changes in productivity and efficiency from system-wide structural changes" in response to changes in volume.

The aggregate analysis presented in UPS-T-1, like all empirical analyses (including Dr. Bozzo's in USPS-T-15), requires – for the sake of feasibility – the use of certain maintained assumptions. In order to feasibly implement the analysis with the available data, I use time-invariant labor weights (w) to aggregate volumes and a time and class-invariant worksharing parameter (λ) to construct my volume index. Fixing w and λ in this manner has the effect of ignoring certain volume-driven changes that may be reflected only in these parameters. Not only am I unaware of any volume-driven changes that are likely to appear only in these parameters, but the treatment of w and λ as fixed is certainly *not* inconsistent with my response above. Even if these parameters

were to truly vary over time or by class, the aggregate analysis presented in UPS-T-1 comes much closer than does Dr. Bozzo's at capturing the full breadth of the Postal Service's responses to changes in volume.

(c) Not confirmed. In assessing the effects of omitting possible explanatory variables one must draw a clear distinction between explanatory variables that are endogenous and under the control of the Postal Service, and variables that are *exogenous, or outside the control of the Postal Service.*

Many aspects of postal operations are likely to affect the structural relationship between mail processing labor costs and mail volume. However, many such aspects of postal operations -- including capital intensity, choice of sorting technology, and the structure and organization of the mail processing network -- are under the control of the Postal Service, and likely themselves to change systematically in response to changes in mail volume. Including such explanatory variables in the regression model without accounting properly for their endogeneity is likely to lead to simultaneity bias. *Moreover, even if the econometric problems associated with the inclusion of a right* hand side endogenous variable could be adequately resolved, the resulting structural model would produce incomplete results. While it would capture the direct effects of volume on labor costs, holding other decision variables constant, it would exclude the indirect effects exerted by volume growth through its influence on these other decision variables.

In such a situation, the appropriate econometric model is a reduced form model that excludes from the right hand side all endogenous variables. The estimated

coefficient on volume in such a model captures both the direct and indirect effects of volume on labor cost. The result is a more comprehensive measure of the volume variability of labor costs, and one that comes closer to meeting the requirements of the Commission.

Certainly, it is basic econometrics that the exclusion from the model of relevant exogenous variables that are correlated with included variables will result in omitted variables bias or inconsistency. All empirical work, including Dr. Bozzo's, is vulnerable to this possibility. Determining whether omitted exogenous variables bias is a substantive concern for any particular application requires consideration of what variables might be missing and what relationship these omitted variables, if they exist, are likely to have with the included explanatory variables. This interrogatory does not give any consideration to these questions, nor does it put forth any explanatory variables that are likely to be excluded from my analysis.

In designing the aggregate cost models presented in UPS-T-1, I have given consideration to what other variables, in addition to volume, might rightly be included in the list of explanatory variables. Obvious candidates included the number of facilities operating in each year and a system-level measure of the degree of mail processing automation. Each of these, however, is a Postal Service decision variable and is jointly determined with costs. In keeping with Dr. Bozzo's analysis in USPS-T-15, the aggregate models in UPS-T-1 exclude endogenous explanatory variables and instead estimate the reduced form effect of changes in volume on costs.

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USPS/UPS-T1-14. Please refer to your testimony, UPS-T-1, at page 64, lines 5-9. You indicate that the cost data for cost segment 3.1 are taken from the Postal Service's response to UPS/USPS-T11-7-17, specifically citing to Tr. 21/9351-9352.

a. Please explain how, if at all, you account for the effect on Cost Segment 3.1 costs of changes in the definition of Cost Segment 3.1 in your aggregate time series analysis, other than conflating the effect with that of volume.

b. If you claim that you account for changes in the definition of Cost Segment 3.1 in response to part (a), please provide detailed citations to the section(s) of your testimony and/or workpapers that describe the variable(s) or other quantitative method(s) you use for this purpose.

Response to USPS/UPS-T1-14.

(a) I have reviewed the documentation on changes in the definition of Cost Segment 3.1 cited by the Postal Service in response to UPS/USPS-T11-8. Several changes in the definition have occurred. Because they do not appear to be of a significant nature, I have not accounted explicitly for these changes.

(b) Not applicable.

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USPS/UPS-T1-15. Please refer to your testimony, UPS-T-1, at page 69, lines 1-8. At lines 5-7, you discuss the "importance of considering capital costs in evaluating the response of mail processing costs to increases in volume." You also refer at lines 7-8 to "Dr. Bozzo's argument that the capital intensity of mail processing is unaffected by growth in mail volume."

a. Please confirm that the three cost segments you analyze in your aggregate time series analysis represent labor costs. If you do not confirm, please indicate which non-labor cost segments you include in your analysis.

b. Please provide a detailed citation to the portion of Dr. Bozzo's testimony containing "Dr. Bozzo's argument that the capital intensity of mail processing is unaffected by growth in mail volume."

Response to USPS/UPS-T1-15.

(a) Confirmed. However, it is important to note that the labor costs associated with the maintenance of mail processing equipment (Cost Segment 11.2) are directly related to and are most certainly positively correlated with the size of the mail processing equipment stock. Thus, as automation or mechanization increases in response to mail volume, the labor costs associated with the maintenance of mail processing equipment will also increase. In this manner, the aggregate models of volume variability that use both Cost Segments 3.1 and 11.2 are able to incorporate labor ***and*** capital responses to changes in mail volume.

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(b) Dr. Bozzo maintains that the capital intensity of mail processing is unaffected by growth in mail volume in at least three separate contexts in USPS-T-15. First, Dr. Bozzo describes the "reasonable assumption" of homotheticity, which he defines on page 40 of USPS-T-15: "Homotheticity implies that changing the level of output of the operation will not alter relative factor demands such as the capital/labor ratio. . . ." The capital/labor ratio is a measure of capital intensity. By assuming that it does not change when output or volume changes, Dr. Bozzo essentially argues that "the capital intensity of mail processing is unaffected by growth in mail volume."

Second, Dr. Bozzo argues that the manual ratio is not volume-variable in section IV.F. of his testimony, USPS-T-15, at pages 56 through 58. The manual ratio is defined as the fraction of letters or flats processed manually and is a measure of capital intensity. By assuming that it is non-volume variable, Dr. Bozzo argues that "the capital intensity of mail processing is unaffected by growth in mail volume."

Third, Dr. Bozzo's labor demand model treats the capital stock variable, QICAP, as an exogenous variable that is not jointly determined, along with work hours, in response to changes in volume. Dr. Bozzo's labor demand model is specified on page 117 of USPS-T-15. If Dr. Bozzo believed that the capital intensity of mail processing is affected by growth in mail volume, he would have had to model the Postal Service's joint decision of work hours and capital. Instead, by treating capital as exogenous in the work hours equation, he implicitly argues that "the capital intensity of mail processing is unaffected by growth in mail volume."

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USPS/UPS-T1-16. Please confirm that the work sharing parameter, λ, that you describe at page 66, line 14, to page 67, line 1, does not vary by class or subclass. If you do not confirm, please explain.

Response to USPS/UPS-T1-16.

Confirmed.

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USPS/UPS-T1-17. Please consider the workhour weights w_j, which you describe in your testimony, UPS-T-1, at page 66, lines 2 and 14.

a. Please confirm that the notation $HRS_{j,98}$ at page 66, line 2, and $L_{j,98}$ at page 66, line 4, refer to the same thing. If you do not confirm, please explain fully the differences between the two.

b. Please confirm that the workhours by class that you use in the construction of w_j do not include workhours from mail processing cost pools other than the nine cost pools in the column headings of the "transition matrix" you present in UPS-T-1, Appendix G.

c. If you confirm in response to part (b), please explain fully why you ignored the mail processing cost pools other than the nine cost pools in the column headings of the "transition matrix" you present in UPS-T-1, Appendix G.

d. If you do not confirm in response to part (b), please provide an Excel spreadsheet containing a detailed derivation of the data you present in UPS-T-1, Appendix H.

Response to USPS/UPS-T1-17.

(a) Confirmed.

(b) Confirmed.

(c) Construction of the labor weights required information on MODS work hours. For this purpose I used data taken from Reg9398.xls provided in USPS-LR-I-107. This source did not include data for non-MODS facilities or for a number of MODs cost pools other than those examined by Dr. Bozzo. To the extent that labor weights

based on these direct MODS pools reflect the distribution of volume by class in indirect MODS pools and in other parts of the mail processing system, the use of the nine cost pools shown in USPS-T-1, Appendix G, should provide a reliable estimate of overall volume variability.

(d) Not applicable.

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USPS/UPS-T1-18. Please refer to your biography at lines 5-6, where you state, "The aviation sector has been a particular focus of my work..." Please indicate whether you have performed any cost, demand, or other economic analysis of the aviation sector in which you have used revenue passenger miles (or kilometers), available seat miles, revenue ton-miles, or other similar measures, to characterize the output of airline(s). If so, for each such study, indicate the output measure you used, and provide a brief description of the analysis you performed (the approximate level of detail of the bullet points in the first several pages of Appendix A to your testimony will suffice).

Response to USPS/UPS-T1-18.

I interpret the word "similar" in the interrogatory to include other measures involving the product of a quantity and a distance. I have not used such output measures in my work, and can therefore identify no such studies.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-19. Please refer to pages 4-5 of your testimony, UPS-T-1, where you indicate (at page 4 line 21 et seq.) that "[t]o some extent, adjustments can be made to accommodate growth in volume, although over a very short time frame the available options may be limited." In the accompanying footnote 4 (on page 5), you indicate that the adjustments you have in mind include "a supervisor ask[ing] workers to defer time off, authoriz[ing] extra overtime, monitor[ing] workers more closely to minimize unproductive downtime, or alter[ing] work practices...to increase productivity." In your opinion, do these "adjustments" typically occur within a time frame of one calendar year or less?

Response to USPS/UPS-T1-19.

Yes.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-20. Please refer to your testimony at page 22, lines 1-2. You state, "It seems highly unlikely that the operations of these parallel processing activities [manual and mechanized/automated operations for shape-based mail streams] would not be affected by the way in which mail is allocated between them." Does your statement imply that a variable (or variables) capturing the allocation of mail or mail handlings should be included in appropriately specified mail processing cost or labor demand models, at least unless a specification test demonstrates it (or them) to be irrelevant? Please reconcile any negative response with the quoted statement.

Response to USPS/UPS-T1-20.

The interrogatory seems to imply a situation in which separate cost or labor demand models are being estimated for each of the parallel processing activities. My response assumes that this is the thrust of the question.

Inclusion of such variables could potentially capture the effects of such interactions if the models were fully and appropriately specified, and if such variables were treated appropriately in calculating volume variability. The latter qualification is an important one. The allocation of mail between parallel sorting activities is a decision made by the Postal Service, and is thus endogenous to the mail processing operation. To the extent that such allocation decisions change with shifts in volume, such indirect effects of volume growth would have to be factored into the calculation of volume variability. See my response to USPS/UPS-T1-13(c).

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Inclusion of cross-activity allocation variables in a set of activity-specific cost or labor demand models is not the only or even necessarily the most appropriate way of capturing the interaction effects cited in my testimony. One might also, for example, combine all of the processing activities for a specific shapes-based mailstream into a single model, and include among the explanatory variables measures of the amount of automated processing capacity available. With more time and study, I am sure that other approaches could be developed.

Hence, I do not believe that the solution offered in the text of the interrogatory is the only one that is workable, or that the specific version of that solution used by Dr. Bozzo (inclusion of a manual ratio variable) is correct.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-21. Please refer to your testimony, UPS-T-1, at page 21, lines 3-14. Does your use of the term "largely" in line 3 of the cited testimony indicate that Dr. Bozzo accounts for potential interrelationships of operations, at least in some way? Explain fully any negative answer.

Response to USPS/UPS-T1-21.

Yes.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-22. Please refer to your testimony, UPS-T-1, at page 21, lines 15-18. You illustrate the interactions between MODS activities with a description of opening unit operations. Please refer also to Dr. Bozzo's response to MPA/USPS-T15-1, Tr. 15/6251-6255, and to the accompanying library reference USPS-LR-I-178.

a. Please confirm that opening unit operations are not among the ten MODS operation groups for which econometric results are presented in USPS-T-15. If you do not confirm, please explain.

b. Please confirm that the MODS sorting operation groups are the "downstream operations" to which your example refers. If you do not confirm, please explain.

c. Is it your understanding that the opening unit models presented by Dr. Bozzo in response to MPA/USPS-T15-1 treat MODS volumes in downstream operations and ODIS destinating mail volumes, among other things, as factors "driving" opening unit workhours? If not, please explain.

Response to USPS/UPS-T1-22.

(a) Confirmed.

(b) Confirmed.

(c) It is my understanding that Dr. Bozzo treats TPH/F and destinating mail volumes as factors "driving" opening unit workhours.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-23. Please refer to your testimony, UPS-T-1, at page 23, lines 15-19. Do you contend that it is impossible to incorporate the measured effect of capital on labor hours in the variability estimates, if desired? If you claim that it is impossible to do so, please explain fully and support your answer with appropriate references to the economic and/or econometric literature.

Response to USPS/UPS-T1-23.

No. However, an appropriate measure of variability must account for more than just the effects of volume on labor hours, holding capital constant. It must also factor in the effects that volume growth has on capital expenditures, as well as its indirect effects on labor hours through its influence on capital.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-24. Please refer to your testimony, UPS-T-1, at page 25, lines 1-2. Please describe the procedures you employed in the "inspection" you claim to have performed.

Response to USPS/UPS-T1-24.

The first phase of this inspection involved manual review of the data contained in reg9398.xls, provided in USPS-LR-I-107, to assess the frequency with which isolated instances of zero TPH/F and/or zero labor hours were reported. I defined these isolated instances as one or more successive quarters of zero or negative values for a MODS activity and a site that are both preceded and followed by reporting of non-zero values. In other words, I excluded periods of zero TPH/F and hours for a site at the beginning or end of the observation period, since such periods could have corresponded respectively to the period before the activity was installed at the site, or the period after it had been shut down. I found many such instances.

The second phase of this inspection involved the development of software to scan the data set and provide a full and accurate count of the number of such gaps in reporting. The computer program developed for this purpose is named GAPS.PRG, and is included in my workpapers. Results of this analysis are reported in Table 5 on page 27 of my testimony.

Although it is possible that some of the gaps identified in this way represent true zeros (i.e., legitimate periods when no mail was processed), they are too numerous and too long to be explained entirely by periods of idleness. Moreover, frequent

inconsistencies between the TPH/F data and the labor hour data demonstrate the existence of numerous reporting errors.

The table below shows the number of instances in which a MODS activity at a site reports either positive TPH/F and zero labor hours, or vice versa. There is no plausible operational explanation for such a pattern. It can be explained only by reporting errors.

Tabie in Response to USPS-UPS-T1-24
MODS Hours and Pieces Data Quality

MODS Group	Pieces <=0	Hours <=0	Hours <=0 Pieces >=0	Hours >0 Pieces =0	0-40 Hours Pieces <=0
BCS	259	246	2	15	3
OCR	656	608	6	52	30
FSM	1872	1839	4	37	28
LSM	2137	1762	5	374	286
Manual Flats	171	156	1	16	2
Manual Letters	167	153	2	14	4
Manual Parcels	1147	852	231	525	187
Priority	1605	981	58	659	110
SPBS	5288	5094	8	202	119

Notes and Sources:

1. Data are from reg9398.xls, provided in USPS-LR-I-107.
2. Following USPS-T-15, pieces for manual operations equal total piece handlings (TPH). Pieces for automated operations equal total pieces fed (TPF), except for observations where TPF<TPH.

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USPS/UPS-T1-25. Please refer to your testimony, UPS-T-1, at page 28, lines 6-9. Please provide a detailed citation to support the explanation you attribute to Dr. Bozzo.

Response to USPS/UPS-T1-25.

See USPS-T-15, page 127, lines 5-7. I misspoke when I included SPBS. The statement by Dr. Bozzo refers only to manual parcel and Priority.

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USPS/UPS-T1-26. Please explain your understanding of the method by which TPH and TPF for SPBS operations are measured. Specifically, is it your understanding that TPH and TPF for SPBS operations are obtained from machine counts?

Response to USPS/UPS-T1-26.

In discussing the recording of first handling pieces for parcels, the Management Operating Data System Handbook M-32 (Docket No. R97-1, USPS-LR-H-147) states in section 212.14 that "In parcel operations, first handling pieces are determined by an actual count of parcels or by standard conversion rates of the number of pieces per container (sack or hamper)."

In section 411, "Recording Procedures," that same document directs personnel to "Use console or meter readings of mechanical processing equipment where available." It also directs personnel to "Record parcel volume by container count, meter readings of parcel sorting machines, or other counters." In section 412.4, "Recording Total Piece Handlings," the manual states that "For machine operations . . . the MOD System records the actual total piece handling from meter readings or printouts rather than from projections."

I infer from the statements quoted from sections 411 and 412.4 of the MODS manual that at least some parcel sorting machines are equipped with counters, and that when counter data is available, it is used to determine TPH.

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USPS/UPS-T1-27. Is it your understanding that bundles of flat-shape Periodicals and Standard A are commonly handled in SPBS operations? If not, please describe the basis for your understanding.

Response to USPS/UPS-T1-27.

Yes.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-28. Is it your understanding that bundles of flat-shape Periodicals and Standard A are commonly handled in manual parcel and/or Priority Mail operations? If so, please describe the basis for your understanding.

Response to USPS/UPS-T1-28.

Postal Service witness Kingsley states that "When pallets and sacks contain bundles made up to finer sortation levels than the container, a bundle sort is required. This is accomplished in a manual or mechanized operation." USPS-T-10 at 19-20. She does not identify where manual sortation takes place. I do not know for certain where such sortation takes place.

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USPS/UPS-T1-29. Please refer to your testimony, UPS-T-1, at page 29, lines 16-18.

a. Is the "trend over time in weight per piece" to which you refer, specifically, a trend over time in weight per piece *at the source/type code level*? If not, please explain.

b. To be "capable of distorting Dr. Bozzo's volume-variability estimates," is it necessary that the effect of the "false trend" not be captured by trend variables included in the regression models? Please explain your answer fully.

Response to USPS/UPS-T1-29.

(a) I was referring to the level at which national conversion factors are specified and applied. I understand based on the Management Operating Data System Handbook M-32 (Docket No. R97-1, USPS-LR-H-147, § 413) that they are specified at the source/type code level.

(b) Yes. Dr. Bozzo does include trend variables in his model, and if all sites shared the same trends in weight per piece, the effects of those trends would probably be captured by Dr. Bozzo's trend variables. However, if each site had its own unique trend in weight per piece, their effects would be captured neither by his trend variables nor by his site-specific fixed effects.

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USPS/UPS-T1-30. Please refer to your testimony, UPS-T-1, at page 29, line 22, to page 30, line 1. Please confirm that your statement would still be correct if it read, "...the fixed effects, the random effects, the pooled and the between estimators will all be inconsistent." If you do not confirm, please provide a mathematical proof that the between estimator is consistent when site-specific measurement errors are present.

Response to USPS/UPS-T1-30.

Confirmed in the case of fixed site-specific measurement error, or measurement error involving site-specific trends in measurement error. Not confirmed in the case of IID (i.e., identically and independently distributed) measurement error. In this latter case, the averaging across time periods that the between model is based upon would tend to reduce the variance of the measurement error, with a resulting loss in bias.

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USPS/UPS-T1-31. Please refer to your testimony, UPS-T-1, at page 32, lines 16-21, and footnote 31.

a. Please confirm that your reference in footnote 31 to page 55 of USPS-T-15 is, specifically, to the paragraph ending at page 55, line 8. If you do not confirm, please explain.

b. If you confirm in response to part (a), please further confirm that the paragraph you cite begins at page 54, line 15, of USPS-T-15. If you do not confirm, please explain.

c. If you confirm in response to part (a), please further confirm that the paragraph you cite begins with the sentences, "The Postal Service's methods recognize that the absolute and relative amount of handlings per piece may vary over time, due to changes in Postal Service operations, mailer behavior, or other factors. The annual updates of the cost pool totals and distribution key shares permit the assumed handling levels and proportions to vary over time." If you do not confirm, please explain.

Response to USPS/UPS-T1-31.

(a) Confirmed.

(b) Confirmed.

(c) Confirmed.

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USPS/UPS-T1-32. Please refer to your testimony, UPS-T-1, at pages 34-35. You indicate at page 34, lines 13-14, that "measurement error in the dependent variable is absorbed in the error term." You subsequently provide estimating equations for the regressions you use to estimate the elasticities of TPH (or TPF) with respect to FHP at page 35, lines 3 and 7.

a. Please confirm that the terms u_{it} in the equations cited above denote the "error term[s]" to which you refer in the statement quoted above. If you do not confirm, please explain.

b. Please confirm that, for a multivariate linear regression, a consistent estimator of the error variance $\sigma_u^2 = \text{var}(u_{it})$ is $\left(\sum \hat{u}_{it}^2\right)/(N_{obs} - K)$; where $\sum \hat{u}_{it}^2$ is the sum of squared residuals from the regression, N_{obs} is the number of observations, and K is the number of regressors. If you do not confirm, please provide the formula you believe to be correct for a consistent estimator of the error variance σ_u^2, and provide a proof (or a citation to a proof) of its statistical properties.

c. Please provide the estimated error variances for each regression reported in Table 6 and Table 7 of UPS-T-1, using the formula that you confirm (or otherwise provide) in response to part (b). If the estimated error variances are provided in your workpapers, UPS-NEELS-WP-1, please provide detailed citations to the locations in the workpapers where they may be found. Otherwise, please provide detailed documentation of the methods you use to generate your response, including computer programs you employ and the output of those programs.

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Response to USPS/UPS-T1-32.

(a) Confirmed.

(b) I do not confirm. A consistent estimator of the error variance σ_u^2 is given by: $\sum_i \hat{u}_{it}^2 /(N_{obs}\text{-}K\text{-}N_{sites})$

where $\sum_i \hat{u}_{it}^2$, N_{obs}, and K are as defined in this question and N_{sites} is the number of mail processing facilities included in the estimation. See page 467 of William H. Greene, Econometric Analysis (New York: Macmillan Publishing Company, 2nd edition, 1993), or page 38 of Cheng Hsiao, Analysis of Panel Data (New York: Cambridge University Press, 1986).

(c) See attached "Table 1 of 2 Prepared in Response to USPS/UPS-T1-32" and "Table 2 of 2 Prepared in Response to USPS/UPS-T1-32." The estimated error variance for all but Parcels in Table 6 of UPS-T-1 is calculated by the program fhptphm.prg, contained in the subdirectory "Appendix – Analysis Program Files/fhptphm.prg" of UPS-Neels-WP-1. The estimated error variance for the shapes level analysis in Table 7 and Parcels in Table 6 is calculated by the program fhptphs.prg, contained in the subdirectory "Appendix – Analysis Program Files/fhptphs.prg" of UPS-Neels-WP-1 (UPS-T-1). The estimated error variance (called "sig2e," in the programs) is calculated in the GAUSS subroutine called "fe." To obtain the estimates for the attached tables, I simply modified fhptphm.prg and fhptphs.prg to print out "sig2e" after the estimation of each model shown in Tables 6 and 7.

Table 1 of 2 Prepared in Response to USPS/UPS-T1-32

Estimates of the Elasticity of TPH with respect to FHP
Imputed from the Reverse Regression of FPH on TPH - MODS Level Analysis

MODS Group	Specification	AR1-Fixed Effects	Ho: Proportionality	F-Statistic	Pvalue	Estimated Error Variance
OCR	Full	1.597	reject	20.304	0.000	0.034
		(0.043)				
	Partial	1.386	reject			0.036
		(0.030)				
LSM	Full	1.069	reject	6.446	0.000	0.184
		(0.030)				
	Partial	0.956	reject			0.189
		(0.018)				
BCS	Full	2.091	reject	25.748	0.000	0.017
		(0.058)				
	Partial	1.560	reject			0.018
		(0.027)				
Manual Letters	Full	1.229	reject	14.606	0.000	0.009
		(0.012)				
	Partial	1.174	reject			0.009
		(0.010)				
FSM	Full	1.544	reject	56.969	0.000	0.006
		(0.027)				
	Partial	1.138	reject			0.007
		(0.012)				
Manual Flats	Full	1.010	reject	9.000	0.000	0.008
		(0.008)				
	Partial	0.969	reject			0.009
		(0.006)				
Parcels	Full	1.795	reject	7.692	0.000	0.139
		(0.099)				
	Partial	1.786	reject			0.143
		(0.088)				
Priority	Full	1.013	reject	1.697	0.030	0.003
		(0.003)				
	Partial	1.010	reject			0.003
		(0.002)				

Notes and Sources:

1. Data from fhp9398.xls and reg9398.xls, provided in USPS-LR-I-186 and USPS-LR-I-107, respectively.
2. Standard errors shown in parentheses.
3. Estimated effects are significantly different from zero and one at or below the 1% significance level.
4. Partial specification regresses ln(FHP) on ln(TPH) and the square of ln(TPH).
5. Full specification regresses ln(FHP) on ln(TPH), the square of ln(TPH), ln(DPT), and a set of 18 time dummies (one for each quarter, excluding the first one).
6. F-Tests (statistics and pvalues shown in table) uniformly favor the full specification.
7. Appendix C of UPS-T-1 shows the full set of estimation results.

Table 2 of 2 Prepared In Response to USPS/UPS-T1-32

Estimates of the Elasticity of TPH with respect to FHP
Imputed from the Reverse Regression of FPH on TPH - Shapes Level Analysis

Shape	Specification	AR1-Fixed Effects	Ho: Proportionality	F-Statistic	Pvalue	Estimated Error Variance
Letters	Full	2.062	reject	14.148	0.000	0.009
		(0.061)				
	Partial	1.689	reject			0.010
		(0.034)				
Flats	Full	1.318	reject	46.449	0.000	0.003
		(0.015)				
	Partial	1.078	reject			0.004
		(0.009)				
Parcels	Full	1.795	reject	7.691	0.000	0.139
		(0.099)				
	Partial	1.786	reject			0.143
		(0.088)				
Priority	Full	1.013	reject	1.697	0.030	0.003
		(0.003)				
	Partial	1.010	reject			0.003
		(0.002)				

Notes and Sources:

1. Data from fhp9398.xls and reg9398.xls, provided in USPS-LR-I-186 and USPS-LR-I-107, respectively.
2. Standard error shown in parentheses.
3. Estimated effects are significantly different from zero and one at or below the 1% significance level.
4. Partial specification regresses ln(FHP) on ln(TPH) and the square of ln(TPH).
5. Full specification regresses ln(FHP) on ln(TPH), the square of ln(TPH), ln(DPT), and a set of 18 time dummies (one for each quarter, excluding the first one).
6. F-Tests (statistics and pvalues shown in table) uniformly favor the full specification.
7. Appendix D of UPS-T-1 shows the full set of estimation results for Letters, Flats, and Parcels. Appendix C shows the full set of estimation results for Priority.

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USPS/UPS-T1-33. Please refer to your testimony, UPS-T-1, at page 35, lines 3 and 7, where you provide mathematical formulas for the estimating equations you employ in your analysis of the relationship between FHP and TPH. Please interpret the term TPH to refer to TPF where appropriate. Please also refer to your testimony at page 34, line 10, where you indicate that you estimated the "reverse regression" of FHP on TPH and other variables.

a. Please confirm that, based upon the estimating equations provided at page 35, lines 3 and 7, the mathematical formula for the elasticity of FHP with respect to TPH is $\partial \ln FHP / \partial \ln TPH = \beta_1 + 2\beta_2 \ln TPH$. If you do not confirm, please provide a mathematical derivation of the elasticity formula you believe to be correct.

b. Please confirm that your estimators of the elasticity of TPH with respect to FHP, used to generate the results presented in Table 6 and Table 7 of UPS-T-1, have the form $(\partial \ln TPH / \partial \ln FHP) = (\hat{\beta}_1 + 2\hat{\beta}_2 \ln TPH^*)^{-1}$, where $\hat{\beta}_1$ and $\hat{\beta}_2$ are the estimates (from Appendix C) of the parameters β_1 and β_2 from the appropriate estimating equation, and $\ln TPH^*$ is the value of $\ln TPH$ at which the elasticity formula from part (a) of the interrogatory is evaluated. If you do not confirm, please provide mathematical formula(s) for the estimator(s) you employ, and also please provide detailed citations to your workpapers, UPS-NEELS-WP-1, indicating where the formula you provide, and the implementation of the formula, may be found.

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c. Please describe the value(s) of $\ln TPH$ you chose to evaluate the elasticity estimator from the response to part (b). Please provide detailed citations to the section(s) of your workpapers, UPS-NEELS-WP-1, in which your calculations are implemented.

d. Please confirm that the estimating equations for the conceptually correct "non-reverse" regression of TPH on FHP and other variables—i.e., the estimating equations you presumably would have employed, if the FHP data were to have appropriate statistical qualities—corresponding to the reverse regressions you actually estimated would be:

$\ln(TPH_{it}) = \delta_i + \gamma_1 \ln(FHP_{it}) + \gamma_2 \ln(FHP_{it})^2 + \gamma_3 \ln(DPT_{it}) + \gamma_4 TimeDummies_{it} + v_{it}$ (the "full estimating equation"), or $\ln(TPH_{it}) = \delta_i + \gamma_1 \ln(FHP_{it}) + \gamma_2 \ln(FHP_{it})^2 + v_{it}$ (the "restricted model"). If you do not confirm, please provide the "non-reverse" estimating equations you believe to be conceptually correct, and explain fully the basis for your belief.

Response to USPS/UPS-T1-33.

(a) Confirmed.

(b) Confirmed, with the exception that estimates for β_1 and β_2 for Parcels in Table 6 are from Appendix D, not Appendix C. Similarly, non-Priority estimates for β_1 and β_2 used for Table 7 are also from Appendix D.

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(c) In keeping with Dr. Bozzo's preferred elasticity calculations presented in USPS-T-15, I evaluate the elasticity of the estimator (Est) from part (b) at the arithmetic sample mean of TPH ($\overline{TPH}$):

$$Est\left(\frac{\partial \ln(TPH)}{\partial \ln(FHP)}\right) = \left(\hat{\beta}_1 + 2 \times \hat{\beta}_2 \ln(\overline{TPH})\right)^{-1}$$

For all but Parcels in Table 6, this calculation is implemented in program fhptphm.prg, contained in the subdirectory "Appendix – Analysis Program Files/fhptphm.prg" of UPS-Neels-WP-1. For all but Priority, the shapes level analysis in Table 7, and Parcels in Table 6, this calculation is implemented in the program fhptphs.prg, contained in the subdirectory "Appendix – Analysis Program Files/fhptphs.prg" of UPS-Neels-WP-1. The estimate of the marginal effect of TPH on FHP ($\beta_1 + \beta_2$ ln TPH) is calculated in the GAUSS subroutine called "mareff." The estimate of the marginal effect of FHP on TPH (($\hat{\beta}_1 + \hat{\beta}_2$ ln TPH)$^{-1}$) is printed out in the GAUSS subroutine called "out."

(d) I do not confirm. The model I estimated cannot be transformed mathematically into the model described in the interrogatory. The "non-reverse" regression of TPH on FHP which corresponds to the model that I have estimated is not the one presented above in USPS/UPS-T1-33(d). The correct "non-reverse" regression equations are implicitly defined by the regression models on page 35, lines 3 and 7, of my testimony.

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USPS/UPS-T1-34. Please refer to your response to USPS/UPS-T1-2(c). The interrogatory read, in part, "if you contend the 100 percent variabilities represent the elasticity of 'X' with respect to 'Y,' provide a precise definition of 'X' and 'Y.'" You responded, "'X' equals mail processing labor cost for a specific MODS pool. 'Y' represents the number of pieces of mail of a specific subclass delivered by the Postal Service." Please also refer to your response to USPS/UPS-T1-4.

a. Please confirm that the "variabilities" defined in your response to USPS/UPS-T1-2(c), in mathematical notation, are the elasticities $\partial \ln C_i / \partial \ln DV_j$, where C_i denotes the labor cost for mail processing cost pool i and DV_j denotes the pieces of mail of subclass j "delivered by the Postal Service." If you do not confirm, please provide the formula you believe to be correct and a full explanation of how it relates to your response to USPS/UPS-T1-2(c).

b. Please confirm that "100 percent variabilities" as defined in your response to USPS/UPS-T1-2(c) imply, in mathematical notation, $\partial \ln C_i / \partial \ln DV_j = 1$, where the variables are defined as in part (a) of this interrogatory. If you do not confirm, please provide a detailed derivation of the mathematical relationship between the elasticity $\partial \ln C_i / \partial \ln DV_j$ and the "100 percent variabilities" you believe to be correct.

Response to USPS/UPS-T1-34.

(a) Confirmed.

(b) Confirmed.

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USPS/UPS-T1-35. Please refer to your response to USPS/UPS-T1-2(d). The interrogatory requested that you provide the "precise economic interpretation(s) of the distribution key shares used by Mr. Sellick to compute mail processing "costs" by cost pool and subclass." You responded, "Mr. Sellick's IOCS-based distribution key shares represent the shares of costs, by MODS pool, accounted for by the various mail subclasses." Please also refer to your response to USPS/UPS-T1-2(b), where you state, "Dividing Mr. Sellick's subclass costs by the corresponding RPW volumes does give the best approximations of the partial derivatives of mail processing labor costs with respect to subclass volumes that are available in this record." Please also refer to Mr. Sellick's response to USPS/UPS-T2-1(c), in which Mr. Sellick confirms that the subclass costs he computes can be expressed as "the product of total cost for the pool, a volume-variability factor equal to (or nearly equal to) one (or 100 percent), and a distribution key share for the cost pool and subclass derived from IOCS data."

a. Please confirm that the "costs" to which you refer in your response to USPS/UPS-T1-2(d) are volume-variable costs, by MODS pool. If you do not confirm, please explain fully.

b. Please confirm that the "volume-variability factor" employed, explicitly or implicitly, by Mr. Sellick would be defined, in mathematical notation, by the formula you confirmed or provided in response to USPS/UPS-T1-34(a). If you do not confirm, please explain fully.

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c. Please confirm that the formula confirmed by Mr. Sellick can be represented, in mathematical notation, as $VVC_{ij} = C_i \cdot \varepsilon_i \cdot d_{ij}$, where VVC_{ij} is the volume-variable cost in cost pool i for subclass j, C_i is defined in interrogatory USPS/UPS-T1-34(a), ε_i is the volume-variability factor (elasticity) you confirmed or provided in response to USPS/UPS-T1-34(a), and d_{ij} is the IOCS-based distribution key share computed by Mr. Sellick. If you do not confirm, please provide the formula you believe to be correct, and explain its derivation fully.

d. Please confirm that your response to USPS/UPS-T1-2(b) implies, in mathematical notation, $VVC_{ij} / V_j^{RPW} = C_i \cdot \varepsilon_i \cdot d_{ij} / V_j^{RPW} \cong \partial C_i / \partial V_j^{RPW}$, where V_j^{RPW} is the RPW volume of subclass j, and the symbol $\cong$ denotes "approximately equals." If you do not confirm, please provide the formula you believe to be correct, and explain its derivation fully.

e. Please describe in detail all assumptions needed for the approximation $C_i \cdot \varepsilon_i \cdot d_{ij} / V_j^{RPW} \cong \partial C_i / \partial V_j^{RPW}$ to hold. For each assumption, please describe in detail and provide all quantitative evidence you have to validate the assumption. If you have no quantitative evidence to validate an assumption, please so indicate.

Response to USPS/UPS-T1-35.

(a) Confirmed.

(b) Confirmed.

(c) Confirmed.

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(d) Confirmed.

(e) A volume variability of 100 percent for some cost pool *i* implies that:

(i) $C_i = \sum_j \alpha_{ij} V_j^{RPW}$.

Inspection of this equation shows that if all volumes double, costs in this pool will also double, as 100 percent volume variability would imply. In this context it is the case that:

(ii) $\partial C_i / \partial V_j^{RPW} = \alpha_{ij}$

(iii) $VVC_{ij} = \alpha \cdot V_j^{RPW}$

(iv) $\sum_j VVC_{ij} = \sum_j \alpha_{ij} V_j^{RPW} = C_i$

(v) $d_{ij} = VVC_{ij} \Big/ \sum_k VVC_{ik} = VVC_{ij} / C_i$

(vi) $\varepsilon_i = 1$

(vii) $C_i \cdot \varepsilon_i \cdot d_{ij} / V_j^{RPW} = VVC_{ij} / V_j^{RPW} = \alpha_{ij} = \partial C_i / \partial V_j^{RPW}$

Equations (ii) though (vii) all follow from equation (i) and the definitions of VVC_{ij} and d_{ij}. Equation (i) follows from the definition of 100 percent volume variability. Thus, the only condition that must hold for the "approximation" given in the interrogatory to hold is for volume variability to equal 100 percent.

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USPS/UPS-T1-36. Please refer to your response to USPS/UPS-T1-3(c). You state, "The relationship between incremental RPW volume and incremental FHP volume will depend upon routing, and, for a given routing, the two will generally vary in direct proportion." You subsequently describe some ways in which "exceptions to direct proportionality between RPW volume and FHP volume may sometimes occur," but contend "Any departures from direct proportionality between FHP volume and RPW volume would have an equal or greater effect on the relationship between TPF and RPW volume."

a. If "routing" is defined as the routing of a piece of mail *within* a mail processing facility, would it be correct to say, "The relationship between incremental FHP volume and incremental TPF (or TPH) volume will depend upon routing, and, for a given routing, the two will generally vary in direct proportion"? If not, please explain fully why not.

b. Please confirm that some of the possible "exceptions to direct proportionality" you describe may have the effect of decreasing FHP per RPW piece (e.g., increased presorting and/or drop-shipping of mail). If you do not confirm, please explain fully.

c. Please indicate whether you have any quantitative evidence to support your contention that, "Any departures from direct proportionality between FHP volume and RPW volume would have an equal or greater effect on the relationship between TPF and RPW volume." If so, please provide and describe in detail all such evidence.

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d. Please explain whether there are possible exceptions to your statement, "Any departures from direct proportionality between FHP volume and RPW volume would have an equal or greater effect on the relationship between TPF and RPW volume." For instance, could a "reconfiguration of the network" add an intermediate processing step without necessarily increasing the number of sorts required to "finalize" a piece of mail to its destination? Please explain.

Response to USPS/UPS-T1-36.

(a) It is probably fair to say that for a given "routing" as defined in the interrogatory, TPH (or TPF) and FHP will vary in direct proportion. However, my ability to answer this question in the affirmative depends heavily on the qualification "for a given routing." As I explain on pages 5-16 of my testimony, I believe that "routing" – meaning, in this context, which sorting activities are present in a plant and how mail flows are organized among them – depends in significant ways on the volume of mail being processed. Assuming such effects away, as this interrogatory does, limits the applicability of my response to an artificial situation likely to be of little practical relevance.

(b) In my response to USPS/UPS-T1-3(c) I did not cite increases in presorting or drop-shipping of mail. However, I do confirm that increases in the presorting or drop-shipping of mail would have the effect of reducing FHP per RPW piece.

(c) I have no such quantitative evidence. However, I note that FHP measures mail coming into the plant, while TPH measures the amount of mail handling within the

plant. Every time a piece of mail generates an FHP count, it also by definition generates a TPH count. It may or may not subsequently generate additional TPH counts. My analysis shows that the relationship between FHP and TPH is not one of proportionality. Thus, any nonlinearity in the relationship between RPW volume and FHP volume is transmitted to the relationship between RPW volume and TPH, and probably amplified. Although I cannot exclude the logical possibility that a change in the relationship between RPW volume and FHP could generate an offsetting change in the relationship between RPW volume and the amount of subsequent handling mail experiences, I am unable to construct a plausible and relevant example in which such a situation occurs.

(d) See my response to USPS/UPS-T1-36(c).

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USPS/UPS-T1-37. Please refer to your responses to USPS/UPS-T1-5(c) and (d). The interrogatories asked you to explain how "increases in cost associated with growth in the number of addresses" are "causally attributable to a subclass of mail" as volume-variable (or marginal) cost (in USPS/UPS-T1-5(c)) and incremental cost (in USPS/UPS-T1-5(d)). Your response to USPS/UPS-T1-5(c) discusses the cost effects of "[a]ccommodating the volumes associated with such new delivery points" and states, "Costs associated with these modifications are causally related to the volume growth caused by the creation of new households and businesses." Your response to USPS/UPS-T1-5(d) reads, "See my response to part (c), above."

a. Please explain whether your response implies that you believe there are no cost consequences of growth in delivery points *independent* of any associated mail volumes.

b. Your response to USPS/UPS-T1-5(c) does not indicate how the "[c]osts associated with these modifications" are causally attributable to a subclass of mail as volume-variable (or marginal) cost. Please explain fully how, if at all, "[c]osts associated with these modifications" are causally attributable to a subclass of mail as volume-variable (or marginal) cost" as originally requested in interrogatory USPS/UPS-T1-5(c).

c. Your response to USPS/UPS-T1-5(d) does not indicate how the "[c]osts associated with these modifications" are causally attributable to a subclass of mail as incremental cost. Please explain fully how, if at all, "[c]osts associated with these

modifications" are causally attributable to a subclass of mail as incremental cost as originally requested in interrogatory USPS/UPS-T1-5(d).

d. If your response to part (a) indicates that you believe there are, or may be, cost consequences of growth in delivery points *independent* of any associated mail volumes, please explain fully how, if at all, such costs are causally attributable to a subclass of mail as volume-variable (or marginal) cost.

e. If your response to part (a) indicates that you believe there are, or may be, cost consequences of growth in delivery points *independent* of any associated mail volumes, please explain fully how, if at all, such costs are causally attributable to a subclass of mail as incremental cost.

Response to USPS/UPS-T1-37.

(a) In the hypothetical situation in which there was a new delivery point that never received any mail, there might be some minimal costs associated with the creation of that delivery point. However, I have to question whether this hypothetical situation in fact ever occurs, and whether it has any practical relevance.

(b) In principal, one could determine the subclass distribution of the costs of modifying the network to accommodate new delivery points by recording separately by subclass the first pieces delivered to new addresses and the subsequent pieces, and then regressing costs of the two different volume vectors. The estimated coefficients on first pieces delivered by subclass would give the required subclass specific costs.

(c) See my response to USPS/UPS-T1-37(b).

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(d) In the hypothetical situation of a delivery point that never generated any mail volume, it would not be possible to assign cost responsibility to individual mail subclasses. However, as I indicated in my response to USPS/UPS-T1-37(a), I question whether such situations actually occur.

(e) See my response to USPS/UPS-T1-37(d).

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USPS/UPS-T1-38. Please refer to your testimony at page 48, line 4, to page 52, line 13, where you address Mr. Degen's argument that the existence of setup and takedown costs explains, in part, less than 100 percent volume-variability factors. On page 48, lines 5-8, you state that "Over at least some range of volumes, Mr. Degen is almost certainly correct. For small increases in volume, these costs will remain fixed and with growth, they will be amortized over ever larger volumes, giving the result that such operations will exhibit economies of scale." With Figure 8, on page 51, you depict "a situation in which costs increase in a stepwise fashion in direct proportion to volume."

a. Please confirm that, for the purposes of discussing Figure 8, it is possible to define "volume" as piece handlings (TPH or TPF)—i.e., the need to perform more piece handlings could result in "replication of a mail processing operation" and thus the "cost-volume" pattern you depict in Figure 8. If you do not confirm, please explain.

b. Please explain whether you believe the "range of volumes" within which setup and takedown costs "will remain fixed" is larger or smaller than the range of TPH or TPF volumes in Dr. Bozzo's dataset. Please provide and describe fully any quantitative evidence you use to support your statement.

c. Please explain whether you believe Dr. Bozzo's models incorporate any constraint or other feature that would prevent the results from indicating 100 percent (or greater) variability of MODS pool costs with respect to piece handlings if your depiction in Figure 8 were correct. If you believe that there are such constraint(s) or other feature(s), please describe each one, provide detailed citations to the portion(s) of LR-1-107 that show its implementation, and demonstrate mathematically how it would prevent

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Dr. Bozzo's results from indicating 100 percent (or greater) variability of MODS pool costs with respect to piece handlings if your depiction in Figure 8 were correct.

d. Please explain whether you believe the "range of volumes" within which setup and takedown costs "will remain fixed" is larger or smaller than the range of volumes likely to result from projected volume changes between FY 1998 (the base year) and FY 2001 (the test year). Please provide and describe fully any quantitative evidence you use to support your statement.

Response to USPS/UPS-T1-38.

(a) Confirmed.

(b) The range of volumes within which setup and takedown costs will remain fixed is smaller than the range of TPH or TPF volumes in Dr. Bozzo's dataset. The evidence, which is discussed on page 52, lines 6-13, of my testimony, shows clearly that over the range of volumes in Dr. Bozzo's dataset, mail processing facilities incurred replication of setup and takedown costs.

In particular, Table 1 and Appendix B of my testimony present the number of machines per site for each PCN listed in the data provided by Dr. Bozzo in Library Reference USPS-LR-I-244. These data show that over the range of volumes between 1993 and 1998, facilities added a significant number of certain types of machines, some of which require setup and takedown costs.

A notable example in the list of equipment is the flat sorting machine. According to the testimony of Mr. Degen, flat sorting machines require setup costs. USPS T-16,

pages 42-43. The average number of flat sorting machines per facilities starts at 5.6 in 1993, and grows over the period covered by Dr. Bozzo's data to 11.3 machines per facility. UPS-T-1, Table 1, page 8. These data indicate that the flat sorting machines setup costs incurred by facilities in 1993 have not remained constant, but rather have more than doubled, over the time period and range of volumes in Dr. Bozzo's dataset.

(c) In general, I believe that a translog model, such as the one used by Dr. Bozzo, can yield 100 percent (or greater) variability. Whether Dr. Bozzo's model gives correct answers depends critically on the validity of the judgments on which his specification and estimation rely.

(d) The range of volumes within which setup and takedown costs will remain fixed will likely be smaller than the projected range of volumes between the base year and the test year. I base this judgment upon the change in machine counts observed in Dr. Bozzo's dataset, and the relationship between the length of the time period covered by his dataset, and the length of the interval between the base year and the test year.

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USPS/UPS-T1-39. Please refer to your testimony, UPS-T-1, from page 52, line 16, to page 53, line 11, where you discuss what you characterize as the "implicit assumption that incremental volume growth occurs in the shoulders of the peak." You state, "There is no evidence to suggest that in fact, incremental volume growth would occur only in the shoulders of the peak."

a. Please provide a detailed citation to the portion of Mr. Degen's testimony that states the assumption that "incremental volume growth would only occur in the shoulders of the peak." If you claim that your statement is not made explicitly but is a clear implication of Mr. Degen's testimony, please reconcile your interpretation with the qualifications he includes in his testimony such as those that you quote at lines 1-2 of page 53.

b. Does your statement at lines 7-8 that, "if all volumes grow proportionately...one would expect staffing levels to grow proportionately in response" implicitly assume constant returns to "scale" (or size, density, etc., as appropriate)? That is, would it be more accurate to say "if all volumes grow proportionately ... one would expect staffing levels to grow proportionately in response if there are constant returns to scale"? Please explain any negative answer.

c. Do you contend that some types of volume growth (e.g., growth in deferrable "non-pref" volumes) cannot be handled in off-peak periods? If so, please explain fully the basis for your contention.

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Response to USPS/UPS-T1-39.

(a) Mr. Degen explains that gateway operations require peak load staffing early in the day and late in the day to ensure that mail can flow quickly to outgoing sorting operations. In his operational analysis of the anticipated effects of increased volume on volume variability for the gateway operation cancellations, Mr. Degen says, "Increases in total collection volume that exhibit the current time distribution will not increase cancellation hours proportionately because the *full staffing early and late in the operation will not need to change*–some of the waiting time will simply be converted to processing time" (USPS-T-16, page 37, lines 20-24, emphasis added).

If Mr. Degen believes both that staffing is dictated by peak load volumes and that "full staffing early and late in the operation will not need to change" in response to increases in volume (USPS-T-16, page 37, lines 22-23), it must be the case that Mr. Degen assumes implicitly that incremental volume growth would occur not during the critical early and late periods, but rather in the shoulders of the peak.

(b) Mr. Degen uses his operational analysis that "full staffing early and late in the operation will not need to change" and that "some of the waiting time will simply be converted to processing time" to support Dr. Bozzo's estimated variabilities. Specifically, Mr. Degen says, "The estimated variability [for cancellation] may seem low, but it is wholly consistent with my operational analysis" (USPS-T-16, page 54, lines 10-11).

On page 53 of my testimony, I re-focus attention from the shoulders of the peak to the critical early and late periods – where volume growth should result in increased staffing needs. During these peak periods, Mr. Degen's rationale supporting Dr.

Bozzo's finding of increasing returns to scale is not defensible, as there is no idle waiting time that can be used to process incremental volume.

Thus, it would be accurate to say that if volume growth during the critical early and late periods were not to result in a proportionate growth in staffing, there would have to be a source of increasing returns to scale other than that identified by Mr. Degen.

(c) Yes, it is my contention that some types of volume growth cannot be handled in off-peak periods. Deferrable mail can, by definition, be deferred. However, not all mail is deferrable.

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USPS/UPS-T1-40. Please refer to your testimony, UPS-T-1, at page 53, lines 19-20. You state, "The need to make full use of downstream processing capacity implies that gateway staffing levels are in fact volume driven."

a. Does "volume driven" necessarily imply 100 percent volume-variability (i.e., is it necessary that there also be constant returns to "scale" for "volume driven" to imply "100 percent volume variability)? Please explain fully any affirmative answer.

b. Do you contend that Mr. Degen describes gateway operations as non-volume-variable, or just less than 100 percent volume-variable? If you contend that Mr. Degen describes gateway operations as non-volume-variable, please reconcile your contention with Mr. Degen's testimony, at page 38, lines 11-13 of USPS-T-16, that "The overall volume-variability of the cancellation operation will tend to be less than 100 percent because of its role as a gateway with varying vehicle arrival times and volumes of collection mail that cannot be forecast with certainty."

c. Please confirm that your shapes-level analysis of Dr. Bozzo's data relates, among other things, hours in upstream gateway operations such as OCR, to volumes in downstream sorting operations that process letter mail. If you do not confirm, please explain fully.

Response to USPS/UPS-T1-40.

(a) No, but the operational analysis cited from my testimony (UPS-T-1, page 53, lines 19-20) is consistent with 100 percent volume variability.

(b) Just less than 100 percent volume-variable.

(c) Confirmed.

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USPS/UPS-T1-41. Please refer to your testimony at page 72, lines 19-21. You state, "if an analysis is conducted at the plant level, it should account explicitly for the effects of changes in the network that alter the number, configuration or operation characteristics of plants."

a. Please confirm that the "pool total costs" for MODS cost pools reported in Table 1 of witness Van-Ty-Smith's testimony, USPS-T-17, reflect the costs for all facilities that have the corresponding mail processing operations in place. If you do not confirm, please explain fully.

b. Please confirm that any net expansion or contraction of a MODS operation between (say) FY 1998 and FY 1999 will be reflected in the difference between FY 1998 and FY 1999 "pool total costs" as computed by witness Van-Ty-Smith. If you do not confirm, please explain.

c. Please confirm that, holding the volume-variability factors constant, the "pool volume-variable costs" as computed by witness Van-Ty-Smith (or witness Sellick in UPS-T-2) will change between (say) FY 1998 and FY 1999 by the same proportion as the "pool total costs" change. That is, for a constant cost elasticity or volume-variability factor ε_i:

$$\Delta VC_i / VC_i^{98} = (\varepsilon_i C_i^{99} - \varepsilon_i C_i^{98}) / \varepsilon_i C_i^{98} = (C_i^{99} - C_i^{98}) / C_i^{98} = \Delta C_i / C_i^{98}$$

If you do not confirm, please explain.

d. Please confirm that the Postal Service's rollforward model accounts for, among other things, the effects on the Postal Service's future costs of planned deployments of capital equipment between the base year and test year. If you do not confirm, please

explain your understanding of how the rollforward model treats planned deployments of capital equipment.

Response to USPS/UPS-T1-41.

(a) Confirmed.

(b) Confirmed. These pooled total costs are used along with estimates of volume variability to construct estimates of volume variable pooled total costs.

(c) Confirmed.

(d) I confirm that the Postal Service's rollforward model reflects future costs of planned deployments of capital equipment between the base year and the test year. However, to the extent that these deployments are a response to growth in volume, their costs should be reflected in the calculation of volume variability. The Postal Service's approach to measuring volume variability does not reflect these costs.

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USPS/UPS-T1-42. Please refer to your testimony at page 72, lines 9-10. Please confirm that, as a matter of economic theory, the "correct result" could be variabilities greater than, less than, or equal to 100 percent, depending on the degree of economies of "scale" (or size, density, etc., as appropriate) actually exhibited by mail processing operations.

Response to USPS/UPS-T1-42.

Confirmed.

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USPS/UPS-T1-43. Please refer to your discussion of your "shapes level" variability analysis at pages 57-59 of UPS-T-1, and the econometric results you present in Appendix F.

a. Please provide, using the method you describe at page 40 of UPS-T-1, a table of the marginal cost implied by your "letters" models for a BCS piece handling (TPH or TPF, as appropriate), an OCR piece handling, an LSM piece handling, and a manual letter piece handling. Please also provide the table in Excel spreadsheet format.

b. Please provide, using the method you describe at page 40 of UPS-T-1, a table of the marginal cost implied by your "flats" model for an FSM piece handling (TPH or TPF, as appropriate) and a manual flat piece handling. Please also provide the table in Excel spreadsheet format.

c. Please provide, using the method you describe at page 40 of UPS-T-1, a table of the marginal cost implied by your "parcels" model for a SPBS piece handling (TPH or TPF, as appropriate) and a manual parcel piece handling. Please also provide the table in Excel spreadsheet format.

d. Please confirm that your "parcels" group excludes the manual Priority Mail cost pool. If you do not confirm, please explain.

Response to USPS/UPS-T1-43.

(a) The shapes level variabilities can only be used to estimate shapes-level marginal costs. They cannot be used to infer MODS-level marginal costs. Thus, I provide the only possible calculation of marginal costs using the letters variability – the

marginal costs of letters. Column (1) of the attached "Table Prepared in Response to USPS/UPS-T1-43" presents estimated marginal costs for letter processing, using 1998 data and the method described on page 40 of my testimony.

(b) See my response to USPS/UPS-T1-43(a) above. Column (2) of the attached "Table Prepared in Response to USPS/UPS-T1-43" presents estimated marginal costs for flats processing, using 1998 data and the method described on page 40 of my testimony.

(c) See my response to USPS/UPS-T1-43(a) above. The attached "Table Prepared in Response to USPS/UPS-T1-43" presents estimated marginal costs for parcels processing, using 1998 data and the method described on page 40 of my testimony.

(d) Confirmed.

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS	FLATS	PARCELS
	(1)	(2)	(3)
1	0.198	1.617	4.418
2	0.357		3.921
3	0.204	1.172	4.495
4	0.199	1.483	2.750
5	0.170	1.355	3.944
6	0.239	1.479	1.509
7	0.203	1.434	4.458
8	0.181	1.571	3.332
9		1.179	
10	0.179	1.251	4.170
11		1.793	4.912
12	0.187	1.155	1.837
13	0.185	1.354	2.618
14	0.123	1.109	4.490
15	0.190	1.436	
16	0.151	1.670	3.982
17			
18			
19	0.440	1.726	
20	0.199	1.439	4.173
21	0.207	1.174	3.166
22	0.315	1.685	3.077
23	0.292	1.952	3.480
24	0.224	1.521	3.176
25	0.153	1.450	4.287
26	0.155	1.308	2.847
27			
28	0.278	1.498	1.758
29	0.164	1.132	1.524
30		1.299	1.854
31	0.162		
32	0.173	1.475	
33			
34	0.612	1.411	
35	0.137		
36	0.283	1.138	5.055
37			
38	0.252	1.761	
39	0.186	1.264	2.230
40	0.129		
41			
42			
43	0.137		2.865
44			
45	0.646	2.350	
46	0.122	0.964	

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS (1)	FLATS (2)	PARCELS (3)
47	0.151		
48			3.404
49	0.156	1.772	1.651
50	0.228	1.255	2.287
51			
52	0.192	1.111	
53	0.191		2.318
54			
55	0.214	1.472	4.540
56			
57			
58	0.195	1.742	3.093
59	0.251	1.359	3.094
60		1.304	
61	0.172	1.614	2.708
62	0.152	1.283	3.483
63	0.172	1.263	
64			3.310
65	0.191	1.315	2.779
66	0.223	1.912	3.862
67	0.199	1.346	
68	0.241	1.225	1.327
69		1.443	
70	0.138	1.577	3.853
71	0.182	1.333	
72	0.219	1.689	3.380
73	0.397	1.802	3.305
74	0.178	1.619	5.685
75	0.161	1.454	1.662
76		1.866	3.940
77	0.159	1.507	3.845
78	0.249	1.676	5.715
79	0.239	1.517	3.579
80		1.070	5.590
81	0.169	1.432	3.102
82	0.212		3.361
83	0.187	1.629	7.444
84		1.085	2.351
85	0.166	1.282	
86			1.318
87			
88	0.117		
89		1.351	
90	0.150	1.240	6.833
91	0.167		
92	0.175	1.363	4.321

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS (1)	FLATS (2)	PARCELS (3)
93	0.179	1.119	
94	0.263		2.754
95	0.107	1.035	
96		1.554	1.153
97	0.150	1.279	
98	0.171	1.337	7.541
99	0.143	1.196	3.648
100		1.276	
101	0.165		
102	0.146	1.250	1.524
103	0.156	1.230	
104	0.211		1.534
105	0.164	1.223	4.851
106	0.191	1.426	
107	0.151	1.566	3.235
108	0.199	1.351	
109	0.153	1.272	
110	0.160	1.257	
111	0.178	0.848	1.118
112	0.185	1.267	
113	0.156	0.981	1.332
114	0.163	1.211	3.498
115			2.592
116	0.176	1.512	
117			
118		1.363	2.223
119		1.350	2.259
120			3.810
121	0.198		1.384
122	0.169	1.135	1.975
123	0.147	1.006	1.987
124			
125	0.164	1.236	2.740
126			
127	0.122		
128			
129	0.176	1.451	3.217
130	0.144	1.404	
131	0.213	1.395	3.527
132	0.200	1.826	3.253
133			4.248
134	0.193	1.707	3.233
135	0.229	1.594	3.033
136	0.217	1.733	3.205
137	0.141	0.989	2.458
138	0.313	1.714	1.947

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS (1)	FLATS (2)	PARCELS (3)
139	0.235	1.623	1.587
140	0.128	1.248	1.844
141	0.201	1.494	3.360
142			
143	0.200	1.477	2.001
144			
145	0.212	1.555	2.660
146	0.210	1.571	3.770
147	0.328	1.854	
148	0.186	1.265	2.829
149	0.164	1.301	4.597
150	0.265	1.765	3.256
151	0.216	1.856	
152	0.215	2.080	4.219
153	0.207	1.569	3.193
154	0.204	1.969	3.163
155	0.196		3.574
156	0.173	1.863	2.570
157	0.219	1.154	
158	0.187	1.133	
159	0.206	1.522	5.066
160	0.182	1.950	
161	0.153	0.999	
162	0.272	1.477	1.056
163	0.131	1.098	1.982
164	0.368	1.343	
165	0.141	1.057	
166	0.200	1.568	
167	0.200	1.389	1.884
168	0.302		1.493
169	0.216	1.236	2.064
170	0.172	1.379	
171	0.179	1.248	
172	0.188	1.486	3.052
173		2.101	
174	0.252	1.475	2.021
175	0.176	1.344	4.077
176	0.179	1.270	2.660
177			
178	0.181	1.303	
179	0.155	1.463	
180	0.182	1.719	0.902
181	0.194	1.353	1.888
182			
183	0.167	1.357	
184		1.314	2.345

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS (1)	FLATS (2)	PARCELS (3)
185	0.213	1.575	
186	0.234	1.290	
187	0.190	1.531	
188	0.137	1.491	
189	0.175	1.363	
190	0.160	1.412	
191	0.290	1.181	
192	0.135	1.237	1.544
193	0.528	1.831	4.876
194	0.128	1.462	1.748
195	0.164	1.347	4.222
196			
197			
198	0.234	1.472	1.634
199	0.208	1.558	2.748
200	0.158	1.273	3.278
201	0.186	1.425	3.342
202	0.241	1.949	4.087
203	0.206	1.476	3.333
204	0.232	1.406	2.628
205	0.155	1.304	1.509
206	0.176	1.473	3.460
207	0.197	1.012	4.284
208	0.184	1.271	3.339
209	0.108	1.090	
210	0.160	1.598	2.434
211	0.173	1.673	
212	0.130	1.226	2.666
213	0.199	1.611	3.678
214	0.184	1.620	2.599
215	0.141	1.272	
216		1.297	3.349
217	0.233	1.692	3.634
218			
219		1.244	3.683
220	0.234	1.013	2.821
221		1.117	
222	0.236	1.235	2.948
223		1.147	
224	0.199	1.175	4.363
225	0.196	0.837	
226	0.193	1.194	1.563
227	0.152	1.179	1.108
228	0.126	1.176	
229		1.058	
230	0.201	1.458	

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS (1)	FLATS (2)	PARCELS (3)
231			
232			
233	0.163	0.993	1.093
234	0.140	1.403	3.693
235	0.210	1.056	2.647
236	0.157		1.424
237	0.190	1.571	4.556
238	0.292	1.122	1.389
239		1.159	1.617
240		0.976	2.485
241		1.265	2.263
242	0.174	1.347	3.777
243	0.124	1.070	1.443
244	0.141		1.436
245	0.153	1.187	
246	0.303	0.961	
247	0.155	1.253	
248			
249	0.148	1.079	1.118
250			
251	0.219	1.051	1.402
252	0.157	1.366	
253	0.158		
254	0.164		1.094
255	0.141	1.357	3.663
256	0.176	1.109	
257		1.135	
258	0.103		14.968
259		1.160	3.689
260	0.203	1.283	1.708
261		1.136	
262	0.165	1.113	
263	0.187	1.298	4.936
264	0.122	1.125	
265	0.205	1.358	2.510
266			
267			
268	0.162	1.423	1.790
269	0.233	1.600	3.640
270	0.198	1.838	3.991
271	0.152	1.356	3.372
272	0.206	1.422	3.933
273	0.209	1.489	2.897
274	0.126	1.035	2.396
275	0.166	1.473	2.630
276	0.221	1.852	2.122

Table Prepared in Response to USPS/UPS-T1-43

Site Id	LETTERS (1)	FLATS (2)	PARCELS (3)
277	0.190	1.459	3.075
278	0.184	1.255	
279	0.101	1.015	2.621
280	0.121	1.389	2.622
281	0.154	1.171	2.695
282	0.258	1.692	4.366
283	0.217	1.291	2.697
284		1.216	3.601
285	0.177	1.118	
286	0.176	1.113	1.940
287	0.186	1.360	2.250
288		1.317	3.970
289	0.204	1.100	3.927
290	0.188	1.295	
291		1.066	2.658
292	0.136	1.110	3.006
293	0.145	1.086	1.924
294	0.134	1.057	2.363
295	0.124	1.432	
296	0.164	1.112	2.195
297	0.148		4.755
298	0.131	1.328	
299	0.154	1.213	
300	0.226	0.995	
301	0.122	0.983	1.559
302	0.112	0.903	1.360
303	0.110		
304	0.182	1.279	3.985
305	0.106		
306	0.134		
307	0.134	0.936	2.365
308	0.228	1.544	
309	0.147	0.989	10.215
310	0.258		
311	0.277	0.990	
312			
313	0.138		
314	0.198		
315	0.200	1.011	1.576
316			
317	0.221	0.934	
318	0.309		
319			
320			
321			

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USPS/UPS-T1-44. Please refer to your testimony, UPS-T-1, at page 30, lines 17-22, where you discuss the use of cubic foot-miles as the "cost driver" for purchased highway transportation.

a. Is it your opinion that cubic foot-miles is an appropriate choice of cost driver for purchased highway transportation. If not, please explain.

b. Please refer to your statement, "To measure the contribution of a particular subclass to purchased highway transportation costs, all one need know is the number of cubic foot-miles." Does the quoted statement indicate your beliefs regarding the appropriate method to develop volume-variable cost by subclass for purchased highway transportation? If not, please explain.

Response to USPS/UPS-T1-44.

(a) Given the presently available data and analytical capability, it is an appropriate cost driver.

(b) In this portion of my testimony, I used this example to illustrate the characteristics and underlying assumptions of the cost driver/distribution key method of attributing cost. I did not intend to comment on how one should measure volume variability for purchased highway transportation. However, as I stated above in my response to USPS/UPS-T1-44(a), I believe that given the presently available data and analytical capability, cubic foot miles is an appropriate cost driver.

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USPS/UPS-T1-45. Please refer to your response to USPS/UPS-T1-9(c).

a. In your response, you state, "The other logical place where the commingled data could have appeared - namely, the SPBS TPH/F data series – held positive values. I assumed that this represented the commingled manual parcel and SPBS data, and that still seems to be the most likely situation." You further state, "I cannot exclude the possibility that the numbers shown as SPBS TPH/F for periods 294 through 295 in site #6 actually represent something completely different..."

   i. Can you "exclude the possibility" that "the numbers shown as SPBS TPH/F" for site #6 represent the machine counts of pieces handled on the SPBS equipment at that site? If so, on what basis?

   ii. If the "numbers shown as SPBS TPH/F" for site #6 represent the machine counts of pieces handled on the SPBS equipment at that site, would that situation be consistent with MODS TPH and TPF recording procedures for mechanized and automated sorting operations, as you understand them? If not, please explain your understanding of MODS TPH and TPF recording procedures for mechanized and automated sorting operations.

   iii. If the "numbers shown as SPBS TPH/F" for site #6 represent the machine counts of pieces handled on the SPBS equipment at that site, would the SPBS TPH/F data for that site be erroneous? Please explain any affirmative answer.

   iv. Can you "exclude the possibility" that, in the periods where zero manual parcel TPH were recorded at site #6, the site simply did not report manual parcel piece handlings anywhere? If so, on what basis?

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b. In your response, you state, "if all parcels were processed together in the SPBS operation, as the TPH data suggests, they would all by definition be SPBS parcels, and it would not make sense to talk of 'commingling' manual parcels and SPBS parcels in SPBS operations." Does this statement imply that you believe that Dr. Bozzo "talk[ed] of 'commingling' manual parcels and SPBS parcels in SPBS operations"? If so, please reconcile your belief with Dr. Bozzo's response to UPS counsel at Tr. 15/6431, lines 2-5, in which he states that the site, "had handled manual and SPBS parcels together up to a point *prior to separating them according to the mail processing technology that was used to sort them*" [emphasis added]. If not, what is the meaning of this statement?

Response to USPS/UPS-T1-45.

(a)(i) I suppose anything is possible. However, if it is the case that the numbers shown as SPBS TPH/F for site #6 for the periods 294 to 295 represent machine counts of the pieces handled on SPBS equipment, I have difficulty understanding Dr. Bozzo's response to UPS/USPS-T15-13. He states in that response that "intermittent reporting of manual parcel piece handlings may reflect periods in which manual and SPBS parcels were commingled."

As I explained in my response to USPS/UPS-T1-9, the use of the term "commingled" implies to me that the two parcel streams were somehow combined. As I also explained in my response to USPS/UPS-T1-9, the fact that there are hours recorded for site #6 for the periods 294 to 295 for both manual parcels and SPBS

indicates to me that during the period in question both operations were up and running separately in site #6. In that case, I interpret the use of the term commingled to mean that the TPH/F data for the two operations were somehow commingled. This interpretation is the basis for my written testimony.

A second logical possibility is that during the period in question all parcels processed by site #6 were processed on SPBS equipment, and that the recorded figures for SPBS TPH/F are the accurate machine counts. This interpretation would be consistent with Dr. Bozzo's use of the term "commingled," and moreover would be consistent with his response to questioning by counsel for UPS as recorded at Tr. 15/6431, lines 2-5. In this case, however, we confront another unsolved mystery: what do the hours recorded for manual parcels signify? Do they represent hours that should have been logged into the SPBS pool? Or are they something else? If so, what?

A third logical possibility is that during the period in question in site #6 both operations were up and running, and that the figures shown for manual parcel and SPBS hours and for SPBS TPH/F are all accurately recorded. In this case, the zeros shown for manual parcel TPH represent missing values. I will readily admit that this is a logical possibility. If, however, this is what was really going on, I am completely baffled by Dr. Bozzo's use of the term "commingled" in his response to UPS/USPS-T15-13. In this situation, nothing is commingled; there are simply some missing values. The Postal Service apparently disagrees with my interpretation of what was going on in site #6 during the period from 294 to 295. After receiving the interrogatories on this issue, I

have reviewed carefully both the available evidence and my reasoning based upon it. However, after doing so, I return to my original conclusion.

I note that under any of the scenarios outlined above, there are gross errors in the manual parcel data for site #6.

(ii) Yes.

(iii) No.

(iv) See my response to USPS/UPS-T1-45(a)(i).

(b) No. See my response to USPS/UPS-T1-45(a)(i). As I state there, I believe that the fact that hours are recorded separately for manual parcels and SPBS operations indicates that both were up and running in site #6 for the period in question.

As I stated in my response to USPS/UPS-T1-9, I believe that this statement is a response to a question posed by counsel for UPS about the handling of manual parcels and SPBS parcels together in the same operation.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-46. Please refer to your response to USPS/UPS-T1-10(b). You indicate that the results reported in the Table Prepared in Response to USPS/UPS-T1-10(b) "suggest that the MODS data series for SPBS and Manual Parcels exhibit gross data errors that exceed acceptable levels, as defined by Dr. Bozzo himself in USPS-T-15."

a. Please confirm that the error rate per your calculations reported in the Table Prepared in Response to USPS/UPS-T1-10(b) for SPBS is 8.45 percent. If you do not confirm, please explain.

b. Please confirm that the error rate per Dr. Bozzo's calculations reported in the Table Prepared in Response to USPS/UPS-T1-10(b) for SPBS is 1.38 percent. If you do not confirm, please explain.

c. Please confirm that the error rates for SPBS both in parts (a) and (b) are within the range of error rates for "routine data," as the term is used in USPS-T-15 at page 106, line 4. If you do not confirm, please explain.

d. Please confirm that, in the statement from your response to USPS/UPS-T1-10(b) quoted above, you meant to refer to the manual Priority Mail series, not SPBS. If you do not confirm, please explain.

Response to USPS/UPS-T1-46.

(a) Confirmed.

(b) Confirmed.

(c) Confirmed.

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(d) The error rate shown for SPBS in my response to USPS/UPS-T1-10(b) exceed the threshold for "average quality" data as specified by Dr. Bozzo in USPS-T-15, page 106, line 5. It does, however, fall within the range for "routine data" cited on page 106, line 4, of Dr. Bozzo's testimony. On page 106, lines 10-11, Dr. Bozzo characterizes the MODS data as being of "approximately average quality," leading me to believe that he was applying the former standard, and not the latter. My response to USPS/UPS-T1-10(b) reflects this belief.

In my response to USPS/UPS-T1-10(b), I may have misspoken when I used the term "acceptable levels" to characterize Dr. Bozzo's testimony on page 106, lines 10-11. Dr. Bozzo uses the data for manual parcels and Priority Mail even though error rates for these groups fail even to reach the standards of "routine data."

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USPS/UPS-T1-47. Please refer to your response to USPS/UPS-T1-11(b), the data you provided in UPS-LR-3, and the file volume.xls, provided in your workpapers, UPS-Neels-WP-1.

a. Please confirm that the volume.xls file contains data for FY1979 and FY1980. If you do not confirm, please explain fully.

b. Please confirm that you excluded the FY1979 and FY1980 data in the volume.xls file from the aggregate time series analysis you present in UPS-T-1. If you do not confirm, please explain fuiiy.

c. With respect to your response to USPS/UPS-T1-11(b), did you exclude the FY1979 and FY1980 data on *a priori* grounds, on the basis of some preliminary analysis you performed, or for some other reason(s)?

d. If your response to part (b) indicates that you excluded the FY1979 and FY1980 data on *a priori* grounds, please state fully the *a priori* grounds that led you to exclude the FY1979 and FY1980 data.

e. If your response to part (b) indicates that you excluded the FY1979 and FY1980 data on the basis of some preliminary analysis you performed, please describe fully and provide the analysis, and indicate in detail how the results of the analysis led you to exclude the FY1979 and FY1980 data.

f. If your response to part (b) indicates that you excluded the FY1979 and FY1980 data for some other reason(s), please state fully all reason(s).

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Response to USPS/UPS-T1-47.

(a) Confirmed.

(b) Confirmed.

(c) I excluded the FY1979 and FY1980 data because of concerns about the reliability of the worksharing data for those years, and not on the basis of some preliminary analysis.

(d) Library Reference USPS-LR-I-117 did not contain worksharing volumes for FY1979 and FY1980 for some worksharing categories (specifically, First Class Carrier Route and Standard A 3/5-Digit). It was unclear to me whether these represented true zeros or missing values. Given this uncertainty, it seemed the safer course to exclude them from the analysis.

(e) Not applicable.

(f) Not applicable.

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-48. Please refer to your response to USPS/UPS-T1-14(a). You state, "Several changes in the definition [of cost segment 3.1] have occurred. Because they do not appear to be of a significant nature, I have not accounted explicitly for these changes."

a. Please confirm that you did not conduct any alternative analysis to determine whether the changes in the definition of cost segment 3.1 are "of a significant nature" with respect to your aggregate time series analysis. If you do not confirm, please explain why you did not describe the analysis in your response to USPS/UPS-T1-11(b).

b. Please confirm that in the FY 1997 and FY 1998 CRAs (computed using the Postal Service's method), the Postal Service included the so-called "migrated" costs in the cost segment 3.1 total. If you do not confirm, please explain.

c. Please confirm that in the FY 1997 and FY 1998 CRAs (computed using the Commission's method), the cost segment 3.1 total is based on essentially the same IOCS-based method as in the previous years. If you do not confirm, please explain.

d. Please confirm that the cost segment 3.1 total in the FY 1997 CRA, using the Commission's method, is $13,147,837,000. If you do not confirm, please provide the figure you believe to be correct, and a detailed citation to its source.

e. Please confirm that the cost segment 3.1 total in the FY 1998 CRA, using the Commission's method, is $13,378,733,000. If you do not confirm, please provide the figure you believe to be correct, and a detailed citation to its source.

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Response to USPS/UPS-T1-48.

(a) The ambiguity of the term "alternative analysis" makes it difficult for me to answer this interrogatory. As I stated in my response to USPS/UPS-T1-14(a), I reviewed the changes that have occurred in the definition of cost segment 3.1 and decided that for purposes of measuring system wide volume variability, they did not appear to be significant. Arguably, this review constitutes an "analysis." If the interrogatory is directed at alternative *econometric* analyses, I ~~note that~~ as I describe in my testimony on page 67, I have run a number of different econometric analyses using different definitions of the dependent variable. For these reasons, I must answer not confirmed. The reason why I did not describe these "alternative analyses" in my response to USPS/UPS-T1-11(b) was that I had described the use of the different definitions of the dependent variable in my response to USPS/UPS-T1-11(a), and USPS-UPS-T1-11(b) asked about alternatives to the models described in my response to USPS/UPS-T1-11(a).

(b) Confirmed.

(c) Confirmed that the total 3.1 dollar amount is from the IOCS total.

(d) Confirmed.

(e) Confirmed.

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USPS/UPS-T1-49. Please refer to your response to USPS/UPS-T1-15(b). You cite material at page 40 of USPS-T-15 to support your claim that Dr. Bozzo argues that "the capital intensity of mail processing is unaffected by growth in mail volume."

a. Please confirm that the material you quote from page 40 is, specifically, from lines 12-13. If you do not confirm, please explain.

b. Please confirm that the entire sentence, including the material you cite, reads, "Homotheticity implies that changing the level of output of the operation will not alter relative factor demands such as the capital/labor ratio, in equilibrium (and other things equal)." If you do not confirm, please explain.

c. Please confirm that the sentence preceding the material you quote from page 40 reads, "In fact, the capital and labor variabilities will be identical, in equilibrium, under the assumption that the cost pool-level production (or cost) functions are *homothetic*" [emphasis in original].

d. Please confirm that the material you cite from page 40 discusses the assumptions required to equate capital and labor variabilities at the cost pool level. If you do not confirm, please explain.

Response to USPS/UPS-T1-49.

(a) Confirmed.

(b) Confirmed.

(c) Confirmed.

(d) Confirmed.

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USPS/UPS-T1-50. Please refer to your response to USPS/UPS-T1-17(c). You indicate that you used data from reg9398.xls to obtain the FY98 MODS hours you use to construct the labor weights for your aggregate volume index, and as a result the reliability of your time series analysis depends in part on the assumption that the labor weights "based on these direct MODS pools reflect the distribution of volume by class in indirect MODS pools and in other parts of the mail processing system..."

a. When you reviewed the available data sources for your analysis, were you aware that FY98 MODS workhours by cost pool, for every MODS cost pool, as well as total BMC and non-MODS workhours from the Pay Data System, are provided at pages I-7 to I-28 of USPS-LR-I-106?

b. If your response to part (a) indicates that you were aware of the data in USPS-LR-I-106, please explain why you chose not to use those data.

Response to USPS/UPS-T1-50.

(a) No.

(b) Not applicable.

CHAIRMAN GLEIMAN: Is there any additional written cross examination for this witness?

MS. DUCHEK: Yes, Mr. Chairman. The Postal Service has some.

CHAIRMAN GLEIMAN: Ms. Duchek, if you would like to approach the witness.

CROSS EXAMINATION

BY MS. DUCHEK:

Q Good morning, Dr. Neels.

A Good morning.

Q I have handed you two copies of your responses to USPS/UPS-T1-52 and -52.

Have you had an opportunity to examine those?

A I have.

Q And would those still be your answers today?

A They would.

Q Mr. Chairman, I am going to hand the reporter two copies of USPS/UPS-T1-51 and -52 and ask that they be entered into evidence.

CHAIRMAN GLEIMAN: I will direct -- if you would please provide those copies to the court reporter, I will direct that the material be received into evidence and transcribed into the record.

[Additional Designated Written Cross-Examination of Kevin Neels,

USPS/UPS-T1-51 and USPS/UPS-T1-52 and Witness Neels' Responses, were received into evidence and transcribed into the record.]

ANSWER OF UNITED PARCEL SERVICE WITNESS NEELS
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USPS/UPS-T1-51. Please refer to your response to USPS/UPS-T1-30. In your response, you do not confirm that the between estimator will be inconsistent "in the case of IID (i.e., identically and independently distributed) measurement error." You further state, "the averaging across time periods that the between model is based upon would tend to reduce the variance of the measurement error, with a resulting loss in bias."

a. Please confirm that, in the case of IID measurement error (with positive error variance), the averaged measurement error has positive variance. If you do not confirm, please explain.

b. Please confirm that, since the averaged measurement error has positive variance in the case of IID measurement error, the between estimator is inconsistent in the case of IID measurement error. If you do not confirm, please explain.

c. Please confirm that it would be incorrect to interpret your usage of the term "loss in bias" to mean that the between estimator completely eliminates inconsistency due to measurement error. If you do not confirm, please explain.

Response to USPS/UPS-T1-51.

(a) Confirmed.

(b) Confirmed.

(c) Confirmed.

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USPS/UPS-T1-52. Please refer to your response to USPS/UPS-T1-33(d). Please provide equations for the "correct 'non-reverse' regressions... implicitly defined by the regression models on page 35, lines 3 and 7" of UPS-T-1. Please also describe your derivation of the equations you provide.

Response to USPS/UPS-T1-52.

The regression models from page 35, lines 3 and 5 of UPS-T-1, shown below, present FHP as a function of TPH and parameters α and β:

(line 3)

$$\ln(FHP_{it}) = \alpha_i + \beta_1 \ln(TPH / F_{it}) + \beta_2 \ln(TPH / F_{it})^2 + \beta_3 \ln(DPT_{it}) + \beta_4 TimeDummies_{it} + u_{it}$$

(line 5) $\ln(FHP_{it}) = \alpha_i + \beta_1 \ln(TPH / F_{it}) + \beta_2 \ln(TPH / F_{it})^2 + u_{it}$.

USPS-UPS-T1-33 and USPS-UPS-T1-52 both ask for an explicit expression of TPH as a function of FHP. However, because of the use of the log transformation and the polynomial functional form, it is generally mathematically impossible to write TPH as an explicit function of FHP.[1]

As I explained in my response to USPS-UPS-T1-33, the models used here *implicitly* define the reverse regression models of TPH as a function of FHP. The existence of the implicit function is guaranteed under the regularity conditions of the

1. There is only one condition on the model under which a singular root exists. However, there is no reason to expect that this condition holds, and thus the quadratic form that implicitly defines TPH as a function of FHP has multiple solutions.

implicit function theorem (see Alpha C. Chiang, Fundamental Methods of Mathematical Economics (New York: McGraw-Hill Book Company, 1984, pp. 205-206).

Furthermore, we can totally differentiate the implicit function relating lnTPH to lnFHP in order to obtain $\frac{d\ln TPH}{d\ln FHP}$. Consider for example the implicit function F for model (3):

$$F(FHP, TPH, X) \equiv \ln(FHP_{it}) - (\alpha_i + \beta_1 \ln(THP / F_{it}) + \beta_2 \ln(TPH / F_{it})^2 + X) = 0$$

where $X = -(\beta_3 \ln(DPT_{it}) + \beta_4 TimeDummies_{it} + u_{it})$. Allowing FHP and TPH to vary, holding all else equal, we can write: $dF_{\ln TPH} d\ln TPH + dF_{\ln FHP} d\ln FHP = 0$. Solving for $\frac{d\ln TPH}{d\ln FHP}$, gives $\frac{d\ln TPH}{d\ln FHP} = \frac{1}{\beta_1 + 2\beta_2 \ln TPH}$ - which is exactly the inverse of the marginal effect of TPH on FHP from the regression of FHP on TPH calculated and presented in UPS-T-1.

CHAIRMAN GLEIMAN: Is there any other additional written cross examination for the witness?

If not, that brings us to oral cross examination.

Two parties have requested oral cross examination, the United States Postal Service and a joint request by eight participants including the Alliance of Nonprofit Mailers, American Business Press, Coalition of Religious Press Associations, Dow Jones & Company, Magazine Publishers of America, National Newspaper Association, the McGraw Hill Companies, and Time Warner.

Is there anyone else who wishes to cross examine?

[No response.]

CHAIRMAN GLEIMAN: Just let me comment that it is very helpful when parties with similar interests make combined presentations. It obviously saves time and money for everyone, and I want to assure the joint participants that the Commission will give their concerns as much weight when presented jointly as we would if there were eight separate attorneys up here plowing through the same grounds during cross examination.

Who will be conducting cross examination for the joint parties?

MR. McBRIDE: Good morning, Mr. Chairman. My name is Michael F. McBride, attorney for Dow Jones & Company, Inc. I will be conducting the cross examination.

CHAIRMAN GLEIMAN: Mr. McBride, if you would like to proceed, you may.

MR. McBRIDE: Thank you.

CROSS EXAMINATION

BY MR. McBRIDE:

Q Good morning, Dr. Neels.

A Good morning.

Q I believe we met three years ago.

A I believe you're right.

Q Nice to see you again.

I was looking through your CV, Dr. Neels, and it appears as if you have testified as an expert witness or otherwise written papers on other matters on a fairly wide variety of industries, is that correct, sir?

A That is correct.

Q Including in the energy industry?

A That is correct.

Q I would like to see if we could agree on some terminology, so what I would like to do is first draw an analogy to another industry and see if we are on common ground at least in our terminology before we turn to mail processing costs.

For that purpose, if it is agreeable with you, I would like to use the example of a large coal-fired electric utility generating station.

Are you familiar generally with that sort of a facility?

A Generally, yes.

Q All right. I would like you to assume this large coal-fired electric generating station is obviously something in which there is a substantial amount of capital invested. Is that a reasonable assumption?

A That is a fair assumption.

Q And a capacity factor of 50 percent. Do you understand what I mean by that terminology?

A I am not sure that I do.

Q That the plant is generating over the course of a year 50 percent of the calculated maximum amount of capacity it is capable of producing.

A I understand you.

Q All right, and that the plant has, let's say, 100 employees. Is that fair?

A Okay.

Q All right. Now would you assume that variable costs of generating electricity from that plant are less than 100 percent, equal to 100 percent, or greater than 100 percent?

A The -- can I ask, just to make sure we are on the same page in terms of definitions, when you talk about the percentage, you are denominator includes what categories of

costs?

Q The plant capital costs, if you will, the costs of the coal, and the costs of the employees and any other costs that are required to generate electricity from the plant.

A So full economic costs?

Q Correct.

A Okay, and the numerator in this case would be defined how?

Q Well, we are talking about the production from the plant, that is, the kilowatt hours or megawatt hours.

A Okay. Well, that would be denominated in kilowatt hours rather than in dollars.

Q All right. So now how would you characterize the numerator in order to answer my question about the variable costs?

A Well, I mean if you are talking about percentages that implies that the numerator has to be denominated in monetary terms and I presume what you would be talking about in this case would be analogous to the percent variability numbers that are being discussed in this proceeding, so it would be the portion of the costs that vary with output and that are not fixed. Is that a fair statement of it?

Q Fair statement.

A Okay.

Q So what is the answer to my question? Would you

expect the percentage of costs that are variable to produce kilowatt hours to be less than, equal to, or greater than 100 percent?

A And the premise is that the plant is currently operating at 50 percent of capacity?

Q That's correct.

A Then I would expect that the variable costs would be something less than 100 percent.

Q All right, sir. Now let's assume that the plant increases output and the capacity factor goes to 55 percent.

Would you expect that the per unit variable cost would be less than, equal to, or greater than the percentage that you just identified, that is a percentage less than 100 percent?

A The per unit variable cost? Are you asking whether the per cent -- the variable cost over total cost would increase, that percentage would increase?

Q Increase, stay the same, or decrease, as the plant increased its output from 50 to 55 percent?

A I would expect that they would increase.

Q They would increase?

A Increase.

Q So you think that as the production from the plant increases the amount of cost that is variable per unit is going to increase?

A From my understanding of coal-fired electric generating plants, those are typically increasing cost units, so the cost of an incremental amount of electricity is increasing as output increases.

Q So in your view, as you increase the output from the coal-fired plant that we have been discussing, there are diseconomies of scale? Is that a fair statement?

A There are increasing marginal costs. On the other hand, there is a portion of fixed costs which probably doesn't vary greatly with output. Now the fact that the -- I think I would characterize the plant as having economies of scale if the percent variability as we have defined it is less than 100 percent, so you could have a situation in which there are increasing marginal costs and hence the variable costs are increasing as output increases, but there's still less than 100 percent, so I think that the two statements are not inconsistent.

Q All right. Please define then for me, if you would, what an economy of scale is and a diseconomy of scale is.

A Well, economies of scale are -- there could be, as I indicated in my last answer, I think you could potentially think about two different ways of looking at it. One question, one way of looking at would be to say, is the marginal cost of -- is marginal cost increasing or

decreasing?

Now, some people would say if marginal cost is increasing, then there are diseconomies of scale. On the other hand, if there are fixed costs that are being spread over a larger base of output such that average cost is declining still as output is increasing, you might also -- you might characterize that as ~~dis~~economies of scale. So, I think it depends upon your definition.

Q Which is your definition?

A I think for most purposes, I tend to regard a situation in which there are increasing marginal costs as one -- well, let me take it back. I think I would adopt a second one as my definition. In other words, if there are fixed costs -- if average cost is declining, then I there are economies of scale. When average cost begins to increase, I would say that there are diseconomies of scale.

Q All right. Now, let's talk still about this electric utility plant. You and I would agree, would we not, that in at least the typical instance, there would be substantial fixed costs?

A Yes.

Q And, therefore, if variable costs are less than 100 percent, if I understand the definition of economies of scale that you just chose, would you characterize the situation that I have hypothesized as one in which there are

returns of scale?

A I would characterize the one you just -- I would characterize the situation you described as one in which, according to my definition, there are economies of scale.

Q Economies.

A Because you would still be at the point where average cost -- on the cost curve, where average cost is declining.

Q But I thought you told me a few minutes ago that you thought there were diseconomies of scale at that plant?

A Well, and I think I clarified that by saying that there were two -- there were alternative definitions people could adopt. I think in the last question, you know, your premise for this line of questioning was we wanted to be on the same page in terms of terms.

Q Right.

A And I think we agreed on the definition of what constitutes economies of scale. And I think I then responded using that set of criteria. In your situation, there still is declining average cost, and so there are economies of scale.

Q Okay. So, if we then are in agreement that where there are substantial fixed costs, and there are, therefore, declining costs of production as production increases, we are in agreement that we can call that a situation in which

there are economies of scale?

A Yes.

Q All right. Now, do you believe that there -- well, let me first ask you this. Turn to another industry. Would you agree with me that there are a small number of automobile manufacturers that account for a large percentage of U.S. production and sales?

A That's correct.

Q Would you agree that a small number of firms with blast furnaces and steel mills account for a large percentage of U.S. production and sales?

A I would agree with that.

Q And would the same be true, that there are a small number of food canners that account for a large production of U.S. production and sales?

A That I am not certain of.

Q All right. Can you think of manufacturing industry where smaller firms seem to have a cost advantage over larger firms?

A Well, I note that, if you looked at the baked goods industry, there are some large producers. There are still a very large number of small producers that seem to, you know, persist and to prosper. So I would say that at least for certain segments of the baked goods market, small firms seem to have some advantage.

Q Is the only one that comes to mind?

A I would have to think about that. I mean I tend to -- in the industries that I tend to have focused on in my work, it is probably more common to see a situation in which there are a relatively small number of firms. Looking at -- you know, at this point, I am going beyond my own work and thinking about what I know in the business press. I noticed that there are still a large number of manufacturers of personal computers that still remain in business. That remains a somewhat fragmented market.

If I think about my experience in the grocery store, there is a lot of different companies putting canned goods on the shelves. That suggests that there might be a lot of firms doing that as well, but I haven't done detailed studies of those industries.

Q I am looking at some U.S. Census Bureau data. Would you regard that as a reliable source of information?

A Yes.

Q And the data for the baked goods industry, their item number 2051, seems to indicate that there are eight companies that make up 49 percent of the production in the industry. Does that sound about right to you?

MR. McKEEVER: Mr. Chairman, I might note that this material was not supplied in advance. I don't know where Mr. McBride is going with it, but it would have been

helpful, I think, if it had been supplied in advance.

MR. McBRIDE: Well, I didn't know he was going to choose the baked goods industry, so I don't know how I could have provided it in advance.

MR. McKEEVER: It is the U.S. Census document that counsel obviously had prepared that he didn't provide in advance.

CHAIRMAN GLEIMAN: I don't see that there is an outstanding objection.

MR. McKEEVER: No, there isn't.

CHAIRMAN GLEIMAN: But we note your concern about the practice. So we can get on with the cross-examination at this point in time.

MR. McBRIDE: Certainly.

BY MR. McBRIDE:

Q Let me ask you this, Dr. Neels, is it your testimony that there are fixed costs in the Postal Service, or are there not?

A My understanding --

MR. McKEEVER: Mr. Chairman, I take it that the question is not limited to mail processing?

MR. McBRIDE: That's correct.

MR. McKEEVER: We may be beyond the scope of the witness' testimony here, but I will not object at this point in time.

THE WITNESS: My understanding is that there are fixed costs in the Postal Service's operations.

BY MR. McBRIDE:

Q Now, let's confine the question, as your counsel suggests, just to mail processing operations. Are there fixed costs in Postal Service mail processing operations?

A Are we talking about the labor costs, or the full costs as we defined them in connection with the coal-fired utility plant?

Q Full costs.

A Full costs. I have -- my work has concentrated on labor costs, so I am not in the position to talk very knowledgeably about the non-labor portion. In the labor portion, I don't believe, based on my own investigations, that there are fixed costs.

In the capital area, I have found some results that suggest that it is possible there may not be fixed costs, but I haven't done a detailed study that would really lead me to a firm conclusion.

Q All right. Is it your testimony that there are diseconomies of scale in mail processing operations?

A My results suggest that there may be, but I have not offered that as an opinion. My testimony at this point is that mail processing costs are 100 percent volume variable, even though, as a number of my statistical results

suggest, you know, it is possible that there may be some diseconomies of scale.

Q Since you say it is possible there are diseconomies of scale, could you explain in plain English, for those of us who are not econometricians, why you think that could possible be true?

A Well, I -- probably the simplest way to explain is that, you know, as I have indicated in my written testimony, I tried to step back and just take a very simple look at what has happened over time. You know, looking at mail processing costs over a 20 year period, relating it to volume after adjusting for changes in worksharing, I looked to see whether labor costs have been increasing more or less rapidly than volume.

Now, it is a very simple model, but it does go directly to the question at issue. And if there were economies of scale, I would have expected to see labor costs growing less rapidly, but, in fact, they seem to be keeping pace with volume or even outpacing volume, depending upon how you set up the analysis.

So, if you look at it, there just -- we don't seem to have a situation where labor costs have been lagging behind volume growth. Now, the operational basis for that, I couldn't describe, but that is what, at a high level, the evidence seems to suggest.

Q All right. Picking up on that point you just made, that on an operational basis, you couldn't describe that, are you testifying that there may be diseconomies of scale because of something you have observed in the real world, or simply that you think that could be true because of numbers that some costing model produced that seemed to show that?

MR. McKEEVER: Objection, Mr. Chairman. I think the assumption in the question that numbers aren't in the real world is an incorrect one.

MR. McBRIDE: Maybe we could find out if the witness understood the question. I am asking if it is something he observed or that was produced by some model.

MR. McKEEVER: I have no objection with the deletion of the term "in the real world" for one option and not for the other. Which I believe counsel just did ask that question.

CHAIRMAN GLEIMAN: In that case, if -- do you still have the question, or would you like the question restated, Dr. Neels?

THE WITNESS: I think I have it. I think -- I have had some opportunities to observe mail processing plants, not as extensive as other witnesses in this proceeding. In trying to look at operations and how mail processing is organized, and to understand from that how you

might have diseconomies of scale, I am somewhat reliant on the testimony of Witness Degen, who presents an operational analysis of mail processing.

I think as part of my testimony, I took a careful look at some of his arguments as to why there should be economies of scale, and I explained reasons why they might be unconvincing. That, for example, he talks about the economies of scale that come from the fact you have set-u and takedown times for a particular piece of mail processing machinery. And I note that it seems to be the case that there are multiple pieces of machinery in a mail processing plant, and one possible explanation for that is that, as volume increases, the number of machines increases proportionately. And so, over large increases of volume, you get direct proportionately of costs.

Some of the other arguments for ~~dis~~economies of scale, I think also have some flaws, or at least can be called into question. So, I think I can answer your question in part by saying that I don't find some of the arguments, the operational arguments that have been put forward for the presence of economies of scale, to be convincing.

Now, could I go further to say that this pushes it in the direction of diseconomies of scale? I haven't tried to extend my analysis of these operational arguments that

far, and that is part of the reason why I am not really prepared to argue at this point that there are diseconomies of scale. I think I said that the opinion I was comfortable with is to say that there are -- that mail processing costs are 100 percent volume variable. And, in part, it is because I can't supply that other part of the argument.

MR. McBRIDE: Thank you, Mr. Chairman.

For now I think at least we will rest there.

CHAIRMAN GLEIMAN: Postal Service? Ms. Duchek.

MS. DUCHEK: Thank you, Mr. Chairman.

CROSS EXAMINATION

BY MS. DUCHEK:

Q Dr. Neels, would you please turn to page 56 of your testimony.

A I have it.

Q I think that is the page on which you discuss your alternative calculations of mail processing volume variability, and if you will bear with me, I am going to summarize them and see if you agree with my summary.

It seems to me you did three things.

Number one, you performed a shape level analysis, is that correct?

A That is correct.

Q And second, you looked at an analysis of the relationship between TPH or TPF, as appropriate, and FHP, is

that correct?

A That is correct.

Q And I think throughout I probably, to make things simpler, will refer to TPH and I think you would understand that I -- in some instances that means TPF.

A That is a useful shorthand.

Q Thank you. It is for me too.

Third, you did what I will term an aggregate time series analysis. Is that also correct?

A That is correct.

Q And on page 56 at lines 22 and 23, you indicate that each leads to variabilities much closer to 100 percent and often in excess of that level, is that correct?

A That is correct.

Q I would like first to look at your shape level analysis. Would you look at Table 8 on page 60 of your testimony, please.

A Okay. I have that.

Q And the estimated variability with respect to TPH from the letters model in that table is .663, correct?

A That is correct.

Q And the standard error is .023, correct?

A Correct.

Q Is the difference between the .663 letters variability in that table and 100 percent statistically

significant?

A It is, although, as I explained in my testimony, I don't regard the .663 as an appropriate estimate of the volume variability of letter processing costs.

Q I understand that, but you still are of the opinion that the difference between 100 percent and the .663 is statistically significant?

A It is.

Q And if you will bear with me, Dr. Neels, and just walk through the remainder of the variabilities in that table, the estimated variability from the flats model is .857, correct?

A That is correct.

Q And the standard error there is .022?

A That is correct.

Q And again would you agree that the difference between the .857 flats variability and 100 percent is statistically significant?

A I would.

Q And the parcels variability in your table is .750?

A That is correct.

Q And the standard error there is .034, correct?

A That is correct.

Q And once again would you confirm for me that the difference between the .750 parcels variability and 100

percent is statistically significant?

A That is correct.

Q And Dr. Neels, the .663 letter variability, do you recall, is that lower than each of the four variabilities that Dr. Bozzo estimates for the separate letter sorting cost pools?

A As I recall, it is.

Q I'm still on Table 8, page 60, Dr. Neels.

You report values for the adjusted or squared statistic for your shape levels models there, correct?

A That is correct.

Q Is it fair to say that an adjusted R square statistic represents the fraction of the variance in the dependent variable explained by the regression model?

A That is correct.

Q In other words, the adjusted R squared statistic tells you something about the goodness of fit of the model, correct?

A It does.

Q In the case of your Table 8, is the dependent variable shape level hours?

A It is the natural log of shape level hours.

Q And the explanatory variables in the shape level models are the natural log of TPH and the other variables included in Dr. Bozzo's models?

A Yes.

Q Okay, and again if you will walk through with me the adjusted R squared for letter shape model is .997, correct?

A That is correct.

Q And for the flat shape model it is .996?

A That is correct.

Q And for the parcel shape model it is .959?

A Yes, all as shown in the tables.

Q Thank you. Do those statistics indicate that there is relatively little variation in shape level hours that is not explained by the explanatory variables included in the shape level regressions?

A That is the implication of it.

Q Did you conduct any formal tests to indicate whether the effects of the variables other than TPH were jointly or individually statistically significant?

A I did not.

Q Would you expect that if you had performed those sorts of appropriate tests the variables other than TPH would have been shown to be jointly significant?

A Not having conducted the test, I am speculating as to what the outcome of that test would be. I don't have strong opinions, prior opinions one way or the other.

To the extent that this specification mirrors that

of Dr. Bozzo's I would expect to find that there would be some similarities in terms of the pattern of significance.

Of course, aggregating across shapes is a fairly substantial change, so it might be different and I wouldn't want to speculate as to what would have happened had I done something I didn't do.

Q Dr. Neels, would you turn to page 72 of your testimony now, and I am looking specifically at lines 9 through 11, where you state, and I am quoting, "In principle, given detailed enough models one ought to be able to arrive at the correct result.

As a practical matter, however, I doubt that such richly-specified models will be achievable in the foreseeable future."

Do you see where I am?

A I see it.

Q Does that statement or those two statements, I guess, refer primarily to the level of detail in Dr. Bozzo's models?

A They do.

Q Do those statements also apply to your shape level models?

A I think they apply there as well.

Q Could a correct result, as you have indicated in that statement on page 72, in principle be variabilities

greater than, less than, or equal to 100 percent?

A In principle, yes.

If we are talking about -- I mean in this section of my testimony I am talking about the -- sort of the shortfall between what we have to work with now and what I would regard as being an appropriately detailed specification.

I think we could expect that the answers would be different, but you can't say a priori what the effect of that difference would be.

Q Dr. Neels, I would ask you to refer to the cross examination exhibit which we provided you the other day.

It is entitled, "Effect on Base Year '98 Volume Variable Costs of Substituting Neels' Shape Level Variabilities Without FHP Adjustment for Postal Service Variabilities."

If you don't have that with you I have additional copies, and if you will give me a minute I will provide one to your counsel and to the Commissioners.

Do you have that in front of you, Dr. Neels?

A I do.

Q Okay. And have you had a chance to examine it?

A I have.

Q Okay. Now, just as an introduction here, I'm not asking you to say that your shape level models are

appropriate to use. In fact, you gave some indication a few minutes ago that you didn't think they are.

I just want to try and get some idea of what the effect of substituting your results for Dr. Bozzo's in the Postal Services volume variable cost calculations would be.

Do you agree that what this cross examination exhibit does is substitute the variabilities from your shapes level models, before your FHP adjustment for Dr. Bozzo's estimates and computes the base year 1998 pool volume variable costs and the composite variability as a result of that substitution for comparison with Dr. Bozzo's results from Table 9 of USPS-T-15, and Witness Van-Ty-Smith's calculation in Table 1 of USPS-T17?

A I believe you have -- I'll accept your description of this table; that's what it appears to be.

MS. DUCHEK: Mr. Chairman, I'm going to hand two copies of what I have designated USPS-Neels-XE-1 to the Court Reporter and ask that they be transcribed into the record.

MR. McKEEVER: No objection, Mr. Chairman.

CHAIRMAN GLEIMAN: It is so ordered.

[Exhibit Number USPS/Neels-XE-1 was marked for identification, received into evidence and transcribed into the record.]

USPS-Neels-XE- /

Effect on BY98 Volume-Variable Costs of Substituting Neels Shape Level Variabilities (w/o FHP adjustment) for Postal Service Variabilities
Costs in thousands of dollars

Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Source	Pool Total Cost, BY98 USPS-T-17, Table 1	Bozzo Variability, Response to USPS/UPS-T15-9 Tr. 15/6386	Bozzo Variability USPS-T-17, Table 1	Neels Shapes UPS-T-1, Table 8	Pool Variable Cost, Response to USPS/UPS-T15-9 C1 x C2	Pool Variable Cost USPS-T-17, Table 1	Neels Shape Variable Costs C4 x C1	Difference C7-C6	% Difference C8/C6
Letter Shape Cost Pools									
BCS	1,043,841	0.897	0.895		936,325	934,238			
LSM	78,765	0.956	0.954		75,299	75,142			
Manual Letters	1,563,964	0.737	0.735		1,152,641	1,149,514			
OCR	219,070	0.752	0.751		164,741	164,522			
Subtotal Letter Shape	2,905,640			0.663	2,329,007	2,323,415	1,926,439	-396,975	-17.1%
Flat Shape Cost Pools									
FSM	1,042,369	0.82	0.817		854,743	851,615			
Manual Flat	459,933	0.773	0.772		355,528	355,068			
Subtotal Flat Shape	1,502,302			0.857	1,210,271	1,206,684	1,287,473	80,789	6.7%
Parcel Shape Cost Pools									
Manual Parcel	60,593	0.522	0.522		31,630	31,630			
SPBS Non-Priority	283,275	0.645	0.653		182,712	184,979			
SPBS Priority	82,446	0.645	0.653		53,178	53,837			
Subtotal "Parcel" Shape (	426,314			0.75	267,520	270,445	319,736	49,290	18.2%
Total	4,834,256				3,806,797	3,800,544	3,533,648	-266,896	-7.0%
Composite /1					78.7%	78.6%	73.1%		

Notes:
1/ Composite is volume-variable cost as a percent of pool total cost for all reported pools

BY MS. DUCHEK:

Q With that exhibit still in front of you, Dr. Neels, do you agree that the composite variability or the ratio of volume variable costs to total costs, using your shape level variabilities as substituted in this exhibit, is 73.1 percent?

A I would agree with that, and I won't belabor the record by noting that I don't accept the validity of the calculation, but certainly that's what's shown here under the assumptions that this was produced under.

Q And that 73.1 percent is lower than the 78.6 percent composite variability resulting from Dr. Bozzo's estimates for the set of cost pools, correct?

A That's correct.

Q Okay. Would it be fair to say that in this exhibit, the reason that the composite is lower, substituting the shape level variabilities into the Postal Service's calculations, is because the letter shaped cost pools, which get a lower variability in the shape level models, are about a billion dollars larger in pool total costs than the combined flat and parcel cost pools?

MR. McKEEVER: Mr. Chairman, may I ask counsel if counsel could specify. I've lost it. If counsel could specify what numbers counsel is comparing, instead of describing them?

MS. DUCHEK: Sure.

BY MS. DUCHEK:

Q I believe Dr. Neels could answer the question if he referred to Column 8 of that exhibit.

They show you basically the net difference.

A Well, as I recall the question, you were -- there were several parts to the question, and you were asking -- one part of it was pointing out that there was a billion dollar difference, roughly, in cost between the letter shaped pool and the combination of flats and parcels.

Q Correct.

A I notice that looking at Column 5, there is a pool cost. Looking at Column 1 --

Q Right, correct.

A There is a pool cost of $2.9 billion for letters, and roughly $1.9 billion for the combination of flats and parcels.

Q Correct.

A I can confirm that part of your question, as I recall it. And as we've already discussed, the composite variability for letters coming out of the shapes regression and not adjusting for the relationship between FHP and TPH is lower than the variabilities produced by Dr. Bozzo.

And that seems to account for all of the difference, all of the reduction in variable costs between

this calculation and Dr. Bozzo's calculation.

Q Okay, thank you, Dr. Neels.

So would it be the case that aggregating to the shape level, again without your FHP adjustment, does not increase volume variable costs overall; it just increases it in selected cost pools?

A I would agree with that, but I regard the correction for the TPH-FHP relationship as being critical to this, and, in fact, one of the main reasons for moving to the shapes level.

Q Understood, thank you.

A couple more questions on the shapes level models, Dr. Neels:

In the parcel model, as I understand it, you combine the SPBS and manual parcel cost pools because they are potentially interrelated; is that correct?

A That's correct.

Q And would that potential interrelationship be something like because smaller, machineable parcels could potentially be sorted in either operation?

A That is correct, and also because over time, as I have indicated in my testimony, there are many cases in which a site had only manual parcel processing and acquired an SPBS at some point during the period covered by the data.

So, you know, I would assume in those cases that

manuals that had once been sorted entirely manually, were divided between the two activities at the end of the period.

Q Now, aren't SPBS and manual Priority Mail operations similarly interrelated?

A They would be.

Q Would you explain why you have chosen to exclude the manual Priority Mail cost pool from the parcel shape level model?

A Well, as my own analysis evolved, I began working with the set of MODS categories used by Dr. Bozzo, and he had combined the SPBS Priority and non-Priority into a single model. And I stuck with that rather than -- you know, as the analysis evolved, I say honestly, I never got around to breaking it down to sort of try and separate out the Priority. And I think that, although it occurred to me late in my analysis that that might be a sensible thing to do, I never -- just never got to it. There was a lot to do in a short period of time.

Q Would you turn now to your response to Interrogatory 43 from the Postal Service, subpart (a)?

A I have it.

Q And you indicate there that, using your shape level models, it is not possible to separately derive marginal costs for piece handlings, for instance, in manual and automated sorting operations, is that correct?

A Well, I think I say you can't infer MODS level marginal costs from shape level models.

Q And that would mean piece handlings in a manual or automated operation, as an example, correct?

A As an example, yes.

Q Did you consider any econometric specifications that would allow you to separately derive marginal costs for piece handlings in manual and automated sorting operations?

A Well, I did some, I think I -- certainly, I worked with Dr. Bozzo's specifications, which allow those calculations.

Q Dr. Neels, now I would like to talk about your analysis of the relationship between TPH and FHP, and I will just reiterate again that by TPH, where appropriate, I also mean TPF. If you would look at page 60, line 11, of your testimony, please.

A I have it.

Q Do you have that?

A Yes.

Q Does that formula indicate a definition of volume variability as the product of an elasticity of costs with respect to TPH and an elasticity of TPH with respect to FHP?

A It does.

Q And you repeat that definition in Note 1 to Table 9 on page 62, as well, is that correct?

A I do.

Q Now, would you take a look at your response to Postal Service Interrogatory 35, subpart (d), please?

A I have it.

Q The formula in that interrogatory response defines volume variability as the elasticity of costs with respect to the RPW volume of subclass (j), is that correct?

A That is correct.

Q RPW volume and FHP volume are not the same thing, correct?

A No, they are not.

Q So, would it be fair to say that these two definitions of volume variability that you are offering are not identical?

A It would only be partially fair. I think what would be completely fair would be to change the definitions that we saw in my testimony to include a third term, which would be the partial derivative of log FHP with respect to log RPW volume. And I think, you know, that is -- there has been some discussion in these proceedings about the proportionality assumption.

Generally, it is assumed that a cost driver is proportional to volume and I believe that FHP -- I think I even said this is in one of my interrogatory responses, FHP is more likely to be proportional to volume. And,

effectively, I have treated the partial derivative of log FHP, with respect to log RPW volume, as equalling one. And I think under that assumption, these definitions are consistent.

Q Would you turn now to your response to Postal Service Interrogatory 3, subpart (d)?

A I have it.

Q Thank you. And you have indicated there, have you not, that you have not conducted any quantitative analysis of the relationship between FHP volume and RPW volume, correct?

A That's correct.

Q If you would look to your response just above that, that is to subpart (c) of Interrogatory 3, at the end of the response, you state, and I am quoting, "Any departures from direct proportionality between FHP volume and RPW volume would have an equal or greater effect on the relationship between TPF and RPW volume." end quote, is that correct?

A That is correct.

Q Now, is it possible that a departure from direct proportionality between FHP volume and RPW volume could be in the direction of less than 100 percent variability between FHP and RPW volume?

A So, in other words, if volume, if RPW volume goes

up by X percent, FHP volume goes up by something less than X percent?

Q That's correct.

A It is possible for that to happen. I would say it is possible. I can't think of an example whereby it would happen. It might happen if there were a change in the configuration of the network such that mail, with increasing volume, mail -- more mail went direct without going through intermediate processing facilities, possibly.

Q Let's assume, hypothetically, that the elasticity of letter TPH with respect to FHP is equal to two and the elasticity of FHP with respect to RPW is one-half. Then, would the elasticity of TPH with respect to RPW volume be the product of those elasticities?

A Assuming that both elasticities were appropriately estimated, I think that would be the case. If it were the case that the relationship between RPW volume and FHP volume were less than one because of an increasing amount of worksharing, that is something I would regard as an exogenous factor that would have to be controlled for, not something that was volume related. So, subject to the qualification that things like that have been appropriately taken care of, I would say yes.

Q So, in the example I have given of the elasticity of two and one-half, the product would be one?

A The product would be one, in that example, correct.

Q Generally, if FHP is less than 100 percent variable with RPW volume, then would the elasticity of TPH with respect to RPW volume be less than the elasticity of TPH with respect to FHP, other things equal?

A Can you run that question by me again? Just -- I am not sure I got all of it.

Q Sure. In general, if FHP is less than 100 percent variable with RPW volume, then would the elasticity of TPH with respect to RPW be less than the elasticity of TPH with respect to FHP, other things equal?

A I believe that would be correct, subject to the qualifications I said before, that in measuring both relationships, non-volume factors have been appropriately taken into account.

Q Now, I would like to ask about your specific interpretation of the TPH, FHP elasticities. As I recall, your estimate of the elasticity of letter TPH with respect to letter FHP is about two, is that correct?

A That sounds about right, and looking at Table 10, I see that is about right.

Q I apologize, I should have referred you to the citation in your testimony. Would that mean, as an example then, that a 10 percent increase in letter FHP would be

expected to result in a 20 percent increase in letter TPH?

A Yes.

Q Hypothetically, if there were 100 percent proportionality between FHP volume and RPW volume, as you generally assume, would it then also be the case that a 10 percent increase in RPW volume would be expected to result in a 20 percent increase in letter TPH, assuming the 100 percent proportionality?

MR. McKEEVER: Mr. Chairman, may I ask for the question to be repeated, please?

MS. DUCHEK: Certainly.

BY MS. DUCHEK:

Q If, hypothetically, there were 100 percent proportionality between FHP and RPW volume, as Dr. Neels generally assumes, would it then also be the case that a 10 percent increase in letter RPW volume would be expected to result in a 20 percent increase in letter TPH?

MR. McKEEVER: Thank you.

THE WITNESS: That would be the case, yes.

BY MS. DUCHEK:

Q So, if a hypothetical RPW letter currently were to require five TPH to be finalized to its destination, and after that RPW volume increased 10 percent, would your model predict that this hypothetical RPW letter would then require six TPH to be finalized to its destination?

MR. McKEEVER: Mr. Chairman, I apologize. I just would like clarification for my purposes of "your model."

MS. DUCHEK: Dr. Neels' model.

MR. McKEEVER: Well, which?

MS. DUCHEK: The letter shape model for TPH and FHP.

MR. McKEEVER: Thank you.

THE WITNESS: Okay. Given my letter shapes model for the relationship between FHP and TPH, and the assumption of a 100 percent variability between RPW volume and FHP, and assuming also that there was a 10 percent increase in letter volume, RPW volume, the implication of that is that TPH would grow by the amount you stated. The average letter would go from five to six, if I am doing all the arithmetic in my head correctly here.

BY MS. DUCHEK:

Q And do you have an operational explanation which would support that result?

A Well, the operational implication of that result would be that at points in the Postal Service's network, more processing steps are being added as volume expands.

A simple way that could happen, as I understand, mail flows would be, if there were -- you might have had a situation where there was a manual processing pool and a bar code sorter.

And so non-bar-coded mail was being processed manually; installation of an optical character reader that applied bar codes to the mail could result in the mail going first through the OCR and then through the bar code sorter, which would be two TPH where before there had been one.

And if that happened at enough locations over the -- around the network, and enough mail was routed through that particular processing stream, that would be one operational explanation.

It could possibly involve some reorganization of processing where there were sequential sorts being carried out.

It would essentially involve the addition of extra processing steps within the plant.

Q Dr. Neels, was the goal of your TPH-FHP analysis to estimate the elasticity of TPH with respect to FHP?

A It was.

Q And at page 34, line 10 of your testimony, do you characterize your modeling approach in that regard as a, quote, "reverse regression," end quote?

A I do.

Q Does the term, reverse regression, basically mean that you've switched the dependent and independent variables in the analysis?

A Well, I think it's a term that's loosely used, and

I'm not sure that it has a precise definition.

That's one interpretation. In the case of a model which is not completely linear, it could involve inverting the function to -- you know, so that what was formerly -- you know, a parameter --

A variable that was formerly embedded in the nonlinear function on the right hand side, subsequently became the dependent variable.

Q Well, let's look specifically at your analysis. Would a direct regression of your analysis have TPH as the dependent variable, and FHP as an explanatory variable?

A Embedded in some functional form, yes.

Q And in your reverse regression, FHP is used as the dependent variable, and TPH is an explanatory variable; is that correct?

A Again, embedded in some mathematical representation, yes.

Q Did you use the reverse regression to avoid potential estimation problems that might result from using FHP as an explanatory variable?

A Yes.

Q And, specifically, would the estimation problem be the potential bias that results from random measurement error?

A That was the concern I had.

Q Okay. So, hypothetically, if FHP were measured without error, you would not have needed to use the reverse regression approach, correct?

A If FHP were measured without error, then presumably you could have used the non-reverse regression.

Q Or what I have termed the direct regression?

A Yes.

Q Okay.

Dr. Neels, would you agree that econometricians generally specify direct regressions appropriately for the problem they're working on?

A Good ones do.

Q Dr. Neels, would you turn to Interrogatory 33 -- your response to Interrogatory 33 from the Postal Service, Subpart (d)?

A I have it.

Q If I understand your answer, you are not confirming that the direct regression equations that look just like your models, but with TPH as the dependent variable and FHP as the explanatory variable, were the correct direct regression models corresponding to your reverse regressions; is that correct?

A I think I do confirm that, and as we talked about before, in discussing the difference between direct and indirect, you can talk about just switching variables from

one side to the other, or you can talk about, in the case of a nonlinear model, mathematically transforming the model to put something different on the right-hand side.

The model that I estimated was nonlinear and it can't be transformed into the model that's presented in this interrogatory, and that was the reason why I didn't confirm that this is my model in direct form.

Q So would it be fair to say that you have had no way to explicitly determine whether the functional form of the direct regression equations implied by your reverse regressions have appropriate properties?

A I haven't examined them.

Q Would you turn now to your response to the Postal Service's Interrogatory Number 52?

A I have it.

Q And if you would turn to the second page of that response, I'm looking at the very last elasticity derivation that you provide. Do you have that?

A I have that.

Q Now, does that elasticity derivation depend on the functional form of your reverse regression?

A It does.

Q So, if your reverse regression had a different functional form, it would follow, would it not, that the elasticity formula using that derivation would be different?

A That would follow.

Q Would you turn now to page 33 of your testimony, please?

A I have that.

Q I'm looking specifically at lines 15 through 16 where you state, and I quote, "First handling pieces counts the unique number of mail pieces entering the facility," end quote.

Now, just to clarify -- yes?

A I have the point you referred me to. I don't have a question.

Q Oh, I'm sorry, I read you that statement, and you see that statement, correct?

A I see that.

Q All right, now I'll go on to my question. Just to clarify, does FHP count all pieces entering the facility or just those pieces that require distribution at the facility?

A My understanding is that it counts pieces requiring distribution.

Q Now, would you turn to page 31 of your testimony, lines 9 to 10?

A I have it.

Q And I'm specifically looking at where you state, and again I quote, "Piece handlings is a measure is conceptually distinct from volume," end quote.

Do you have that?

A I have that.

Q And then you further go on in lines 12-13 to state, and again I quote, "A piece handling, however, is generated each time a piece of mail at a specific site is processed in a particular sorting activity. Thus, in the vast majority of cases, a single piece of mail will generate many piece handlings as it makes it way from origin to destination." End quote.

Now, do those statements illustrate the conceptual distinction between piece handlings and volumes?

A They do, and let me elaborate a little bit on this: There is some volume of mail that bypasses sorting activities entirely.

So that's one basis for the distinction between RPW volume or the volume of mail tendered for delivery, and piece handlings.

In addition, the other -- if you sort of then focus on the mail that does get sorted, because those are the activities that were the focus of Dr. Bozzo's testimony, then there's a difference between the one piece of mail and the number of times it goes through -- the number of times it's processed, generating a piece handling at each of those steps along the way.

I think those are the two main differences, as I

understand it, between the measure -- between volume and piece handlings.

Q Dr. Neels, I would like to ask you now a few questions about your aggregate time series analysis, and I would ask that you turn to Postal Service Interrogatory 48, subpart (a), please.

Do you have that?

A I have that.

Q Specifically I am focused on where you, quote, you indicate that you, quote, "reviewed the changes that have occurred in the definition of cost segment 3.1 and decided that for the purposes of measuring systemwide volume variability they did not appear to be significant. Arguably this review constitutes an analysis."

Does this statement indicate that your review that you are speaking about was qualitative rather than quantitative?

A It does.

Q Okay. Now in your response to 48(a) you talk about describing different definitions of the dependent variable. In your response to Interrogatory 11(b) you make that reference.

Do those definitions of the dependent variable that you are referring to there involve including additional CRA cost segments in the costs you used as the dependent

variable?

A I am trying to collate this against the earlier interrogatory that is referred to there.

Q That's fine. Take your time.

A If you could bear with me for a moment.

Yes. I did conduct, in the aggregate analysis I used three different dependent variables that added different cost segments to the segment 3.1 total and that was what I was referring to, I believe, in the earlier Interrogatory 11, in my response to earlier Interrogatory 11.

Q Okay, and so just to make sure we are clear, what I was trying to confirm was that you -- this didn't involve investigations of the effects of definition changes to cost segment 3.1? Correct?

A That is correct.

Q Would you consider using data based on a consistent definition of cost segment 3.1 in all years to be a generally preferable approach for the purposes of your time series analysis to using data where the definition of cost segment 3.1 has changed?

A I mean as a general proposition, yes. I mean there is evolution over time sometimes in definitions capture changing realities, so I think you would have to get down into the specifics of it.

Q And do you agree that the Postal Rate Commission's definition of cost segment 3.1 is also the definition advocated by UPS Witness Sellick in this proceeding?

A Yes.

Q Dr. Neels, did you run any regressions using FY '97 and FY '98 costs according to the Commission's and UPS's definition of cost segment 3.1?

A I have not.

Q Did you run any regressions using the subset of data for the period of time covered by Dr. Bozzo's and/or Dr. Bradley's analyses?

MR. McKEEVER: Mr. Chairman, I am assuming we are still talking about the aggregate time series analysis only?

MS. DUCHEK: Yes, we are.

MR. McKEEVER: Thank you.

THE WITNESS: I have not run it for those shorter time periods.

Those periods would be significantly shorter and would leave very little data with which to try and infer any statistical relationships.

BY MS. DUCHEK:

Q If I could ask you now to turn to page 70 of your testimony, Dr. Neels and look at Table 12.

A I have it.

Q And, Dr. Neels, I would also like you to take a

look at the cross examination exhibit we supplied previously to you.

It is the one entitled "Confidence Intervals for Parameter Estimates in USPS-T-1 Table 12."

We will mark that as USPS/Neels Cross Examination Exhibit 2, and we can provide you another copy of that.

We will provide one to your counsel and to the Commissioners.

CHAIRMAN GLEIMAN: USPS-Neels-XE-2 was marked for identification.

[Cross-Examination Exhibit USPS-Neels-XE-2 was marked for identification.]

COMMISSIONER LeBLANC: Could I ask the attorneys to check their mikes, if you don't mind. We are getting some backfeed here. After you have finished speaking, make sure that they are off, please. Thank you.

BY MS. DUCHEK:

Q Do you have that, Dr. Neels?

A I do.

Q Now if you would look at page 70 of your testimony, Table 12, the column entitled MP Clerks and Handlers, does that contain the highest estimates of both the volume variability and work share parameter that you report in the table?

A It does.

Q And in the cross-examination exhibit, have the volume variability and work share estimates and standard errors been correctly transcribed from that column in Table 12 in your testimony?

A They have been.

Q Does the cross-examination exhibit accurately present the upper and lower bounds of the 90, 95, and 99 percent confidence intervals for those parameters assuming that the estimators are normally distributed with mean and standard error given by the estimates you report in Table 12?

A It appears to. I haven't verified the calculations but they look correct.

Q Well, would you accept that they are, subject to check?

A Yes.

[Pause.]

MS. DUCHEK: Mr. Chairman, I am going to hand two copies of the Confidence Intervals for Parameter Estimates in USPS-T-1, Table 12 that have been marked as USPS-Neels Cross Examination Exhibit 2 to the reporter and ask that they be transcribed in the record.

MR. McKEEVER: No objection, Mr. Chairman.

CHAIRMAN GLEIMAN: So ordered.

[Cross-Examination Exhibit USPS-Neels-XE-2 was received into evidence and transcribed into the record.]

USPS-Neels-XE- 2

Confidence intervals for parameter estimates in UPS-T-1, Table 12

			Confidence intervals /2					
	Estimate	Standard error	90% confidence interval /3 Lower	90% confidence interval /3 Upper	95% confidence interval /4 Lower	95% confidence interval /4 Upper	99% confidence interval /5 Lower	99% confidence interval /5 Upper
Volume Variability	1.193	0.303	0.695	1.691	0.599	1.787	0.412	1.974
Work Share	0.855	0.256	0.434	1.276	0.353	1.357	0.196	1.514

Notes
1/ Source: UPS-T-1, Table 12
2/ Based on normal distribution
3/ Estimate +/- 1.645 x Standard error
4/ Estimate +/- 1.96 x Standard error
5/ Estimate +/- 2.576 x Standard error

BY MS. DUCHEK:

Q Dr. Neels, one final series of questions. If you would turn, please, to your response to Postal Service Interrogatory 47, in particular subparts (c) and (d).

A I have it.

Q If you will bear with me a minute, I don't.

[Pause.]

BY MS. DUCHEK:

Q You indicated there that you excluded the FY '79 and FY '80 observations from your time series regressions because you did not know whether some of the volume data in Library Reference I-117 -- that is Postal Service Library Reference I-117 -- represented true zeroes or missing values. Is that a correct assessment of your response?

A That is.

Q What material did you review to try to determine whether or not the data to which you refer were or were not true zeroes?

A As I recall there were some footnotes to the table that I thought were subject to ambiguous interpretation at the time, and that was really the only information I had in front of me at the time to make the decision.

Q If you had been able to determine whether those data were true zeroes or that those data were true zeroes would you have included them in your time series regression?

A I probably would have.

MS. DUCHEK: I have no further questions. Thank you very much, Dr. Neels.

CHAIRMAN GLEIMAN: Is there any follow-up?

[No response.]

CHAIRMAN GLEIMAN: I would like to take a five-minute break right now, if it is okay with everyone. We may have some bench questions.

[Recess.]

CHAIRMAN GLEIMAN: Before I ask the few questions that we have, I just wanted to mention, and I should do this at the beginning of each day until we get used to it, inasmuch as we are broadcasting the proceedings over the Internet now, when you are not participating in the sense of asking or answering a question, or making a motion, you should turn your mike off. If you perchance lean over and talk to someone next to you while your mike is on, it is going to be broadcast. So you have to remember that, and I probably have to remember it more than most of you.

Having warned myself and you, maybe I ought to turn the mike off before I ask these questions so as not to embarrass myself. But I guess I am in so deep now that it doesn't matter. Just a few questions to get your overall professional view in our continuing effort to sort things out.

Do you think that the Postal Service could assemble a data set that would be more acceptable for an econometric study of mail processing labor costs than is currently the case?

THE WITNESS: I have a great respect for --

CHAIRMAN GLEIMAN: Now, you will have to turn yours on or we won't have your answers broadcast.

THE WITNESS: I think that they could. I mean I have respect for the Postal Service's data collection ability. I do think such a data set would have to address the issue of finding an appropriate cost driver, which, as I flag in my testimony, is I think one of the big unresolved problems in this area.

CHAIRMAN GLEIMAN: Do you MODS could be used for this purpose?

THE WITNESS: With appropriate modifications, I think it probably could. It might involve trying to get a better handle on the mail coming in to a mail processing plant, which, as I understand it now, is an imperfect measurement process.

CHAIRMAN GLEIMAN: As a practical matter, how can the Commission judge whether a data set is sufficiently large, complete and error-free to give an econometrician a good opportunity to obtain reliable estimates of variabilities?

THE WITNESS: Well, you mentioned size, cleanliness and reliability, were those your three adjectives there?

CHAIRMAN GLEIMAN: Size, how complete and how error-free.

THE WITNESS: Well, I think for size, you know, there, essentially, the test has to do with the precision of the estimates. Does it give results that are statistically significant and precise enough to support decision-making? And that is probably a relatively easy hurdle to cross. Completeness, I think means that you need to have data on all of the factors that people agree are important in determining costs for mail processing. So that I think, for example, you know, my comments about the need for a good reliable cost driver come under that heading.

I think probably having a better understanding of the relationship of capital costs and labor costs probably comes under that heading, too. I think the guide there is to ask whether the -- sort of the factors that have been identified in these discussions are adequately represented in the data set.

Now, then as far as reliability or cleanliness of the data, I think there has been a lot of discussion about error rates and cleaning procedures and, you know, what are the obviously problems that show up in the data series. I

think if, you know, as Dr. Bozzo notes, all data sources have some degree of error and I think you would need to figure out, you know, what percentage of the observations are infected by obvious problems, and, also, what are the causes of those. I think this is a point I made in my testimony in R97.

I think you need to understand why it is breaking down to have a sense of what biases are present. And that leads back to, I guess an assessment of, is there some quality control on the data collection procedures? Are people going back and looking to make sure that, you know, procedures are being followed and adhered to, and that obvious problems are being identified and corrected? That is an ongoing process, and I think a reliable data set should have, you know, some of that kind of support.

CHAIRMAN GLEIMAN: Am I correct that you found the R97 mail processing variability adequately justified by evidence that mail processing operations exhibit approximately constant returns to scale?

THE WITNESS: This is in R97?

CHAIRMAN GLEIMAN: Our R97.

THE WITNESS: Our R97.

CHAIRMAN GLEIMAN: The Commission's.

THE WITNESS: Yes. I think that, certainly, in R97, I was not persuaded by the evidence that there were

constant returns, or that there were less than constant returns to scale. And, you know, I think there was also some evidence on some of the cross-sectional analyses to support constant returns to scale. So I think in that proceeding I was generally unsatisfied by the state of the evidence, but, given that a decision had to be made, I recommended then going ahead with constant returns to scale assumptions. I think the record is more complete here and provides more support for that conclusion.

CHAIRMAN GLEIMAN: Have you done any additional analysis for this case that bears on that conclusion?

THE WITNESS: Other than what is reported in my testimony?

CHAIRMAN GLEIMAN: Yes.

THE WITNESS: The only additional information, which has just become available, is in preparing for my testimony, I did check to see what the effect was of omitting the '79 and '80 observations from the aggregate analysis. That was the subject of some questioning. And I haven't laid eyes on those results, but it is reported to me that they don't substantively change my conclusions.

CHAIRMAN GLEIMAN: Thank you.

THE WITNESS: That is the only other additional analysis I have carried out.

CHAIRMAN GLEIMAN: Okay. Thank you. Those are

all the questions I have, and my colleagues don't appear to have any questions for you, which brings us to follow-up questions from the bench.

[No response.]

CHAIRMAN GLEIMAN: There doesn't appear to be any follow-up. I often wonder when there is no follow-up to questions we ask, whether the questions were just bad questions or the answers were not answers that people concern themselves with. One of these days I will figure that out.

Would you like some time with your witness for redirect, Mr. McKeever?

MR. McKEEVER: No, Mr. Chairman, we have no redirect.

CHAIRMAN GLEIMAN: All right. If there is no redirect, then, Dr. Neels, that completes your testimony here today. We appreciate your appearance and your contributions to the record. We thank you and you are excused.

THE WITNESS: Thank you, sir.

[Witness excused.]

CHAIRMAN GLEIMAN: Having taken a short break, we are now going to take our 10 minute mid-morning break a tad late today. When we return, we will attempt to get Witness Hays' testimony into the record and designated written

cross, and then we will proceed with Mr. Sellick, the next UPS witness. Thank you.

[Recess.]

CHAIRMAN GLEIMAN: Ms. Noble, would you like to proceed with Witness Hays' testimony.

MS. NOBLE: I would, thank you, Mr. Gleiman. I now would like to have entered into evidence and transcribed into the record without the witness's appearance, the testimony of Keith Hay on Behalf of Magazine Publishers of America, Advo; Alliance of Nonprofit Mailers; American Business Media; Association for Postal Commerce; Association of American Publishers; Coalition of Religious Press Associations; Direct Marketing Association; Dow Jones and Company; Mail Order Association of America; McGraw Hill Companies, Inc.; National Newspaper Association; Parcel Shippers Association; and Time Warner, Inc.

The testimony of Mr. Hays is designated as MPA-T-4. There is a limited amount of discovery filed on it.

No one has requested cross examination of Mr. Hay, and I have attached to each of the two copies, a declaration by Mr. Hay, adopting the document as his testimony.

The attachments are fax copies; the originals will be filed later today when they arrive from Canada.

CHAIRMAN GLEIMAN: There was also some Designated

Written Cross Examination for the witness.

MS. NOBLE: That's correct.

CHAIRMAN GLEIMAN: Do you have a certification for that material also?

MS. NOBLE: I do not, but that can be provided if it's necessary, in addition to the certification that we have regarding the other testimony.

CHAIRMAN GLEIMAN: Unless there's an objection, I'm going to assume, since there was discussion between the Postal Service and the moving party, that there is agreement on the Designated Written Cross Examination, and the certification is sufficient along with whatever was filed with the particular interrogatory responses.

If you would hand two copies of the testimony, the Designated Written Cross Examination, and the certification you have, I'll direct the Court Reporter to transcribe that material into the record, and it will be introduced into evidence.

[Written Direct Testimony of Keith Hay, MPA-T-4, and Designated Written Cross Examination of Keith Hay was received into evidence and transcribed into the record.]

MPA-T-4

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON DC 20268-0001

POSTAL RATE AND FEE CHANGES, 2000	Docket No. R2000-1

DIRECT TESTIMONY
OF
KEITH HAY
ON BEHALF OF
MAGAZINE PUBLISHERS OF AMERICA, INC.
ADVO, INC.
ALLIANCE OF NONPROFIT MAILERS
AMERICAN BUSINESS MEDIA
ASSOCIATION FOR POSTAL COMMERCE
ASSOCIATION OF AMERICAN PUBLISHERS
COALITION OF RELIGIOUS PRESS ASSOCIATIONS
DIRECT MARKETING ASSOCIATION, INC.
DOW JONES & COMPANY, INC.
MAIL ORDER ASSOCIATION OF AMERICA
THE McGRAW-HILL COMPANIES, INC.
NATIONAL NEWSPAPER ASSOCIATION
PARCEL SHIPPERS ASSOCIATION
and
TIME WARNER INC.

I. Autobiographic Sketch

My name is Keith Hay, I am Professor of Economics at Carleton University in Ottawa, Canada. I am also the President of Econolynx International Ltd., a company specializing in economic research.

I was educated at the University of Southampton, in the United Kingdom; at the University of Toronto, in Canada; and Brown University, in the United States. I was a U.K. State Scholar, a Ford Foundation Fellow and a Killam Foundation Fellow. I am also a Fellow of the Foundation for Advanced Information Research in Japan. I have been "Visiting Professor" at the University of Southern California; York University, in Ontario Canada; and the University of Alberta (Japan Foundation), in Canada.

Over the last quarter century, I have undertaken some two hundred research assignments, often acting as an international consultant for such organizations as: the World Bank, the Asian Development Bank, the Inter-American Development Bank, the Bank of Canada, the Canadian International Development Agency, the Organization of American States, and numerous international corporations, trading companies and banks. I was executive assistant to Simon Reisman - - the "father" of the Canada-US Auto Pact and the Canada-US Free Trade Agreement - - during the period when Canada was formulating its modern free trade policies. Most recently, I have been working on the proposed Canada-Japan Free Trade Agreement, assessing the potential gains and losses.

I have worked for Canada Post on a number of assignments, most significantly, the development and maintenance of a large database of parcel competitor service standards, marketing incentives and customer rates. I serve as an adviser to several Canadian high-technology companies and I have been the CEO of a publicly quoted software company. I am a citizen of both Britain and Canada, and I live in Ottawa, Canada.

Perhaps the most significant experience I bring to these proceedings is the fact that A.T. Kearney employed me as the technical editor on the Data Quality Study. I was tasked with reading all the component studies compiled by the various experts to ensure that they read well individually, and that collectively they had some cohesion. As such I met often with the authors and discussed the various data quality issues at length. I believe this gives me an excellent insight into the subject of "Data Quality and Rate Making."

II. Purpose and Scope of Testimony

Data quality is fundamental to sound decision making based on sample statistics. Good decisions must therefore rely on good data. Postal rate making in the United States is viewed from the outside as setting "best practices" for the world, by adhering to the highest standards of scientific method and statistical application. Accountability, transparency, methodology and the ability of third parties to replicate statistical methods and sample results are the key-stones of the high standards desired by the Postal Rate Commission, the United States Postal Service and its end-user stakeholders.

The cost of mistaken decisions based upon inappropriate cost estimates could potentially be severe for the stakeholders and for the credibility of the US rate-makers. Moreover, there is no going back; once the standards for research integrity are lowered, the floodgates will open and science-based rationality will prove difficult to enforce in the future. While the desire for a quick answer or fix may be understandable,k the risk of making a mistaken decision is much greater to the shareholders and American consumers than any benefit of a quick answer derived from applying non-random and judgmental statistical procedures.

When there is no study design, a lack of pre-set confidence limits, weak adherence to consistent random sampling, no statistical cost study questionnaire, variable decision rules, no training manuals for enumerators or great concern about consistency of data collection, and only *ex post facto* attempts to get stake-holders to buy into results, then the interpretation of the arising results must be treated very warily. Recent work by Mr. Raymond and Mr. Baron reworking an Engineering Standards Study to produce inputs for cost-estimates appears to exhibit many of the afore-mentioned shortcomings.

In and of themselves, Engineering Standards studies have important roles to play in determining time and motion aspects of route performance. However, the data acquisition methods applied in ES research are quite different and often

inappropriate for ratemaking purposes. This is a situation in which wrongly applied "any data" (arising from the ES study) may be worse than "no data" (from statistical cost studies) and the compounding of decision making errors cannot be justified. The budget costs – and delay -- of undertaking a scientifically sound, well designed, statistical study, as suggested by the Data Quality Study, in the immediate future are dwarfed by the likely value of the improvements in sample accuracy, data quality and avoidance of rate making errors.

In my testimony, I review some issues of statistical research in decision making; look at concerns about data collection methodology, and discuss the question "is any data better than no data?"

III. Value Of Research in Decision Making

a. Scientific Method in Statistical Studies

As is well known, there is a long history of the use of scientific method in survey research. Probability theory has been ably applied for almost a century to the issue of obtaining estimates of the parameters of a population based upon random sampling of that population. The structuring of the research project requires careful planning, which involves:

- consulting early with clients, end-users and decision-makers likely to be affected by study outcomes (stakeholders);
- reviewing previous studies/literature;
- determining a set of questions to be answered or objectives to be fulfilled;
- adopting the appropriate null hypotheses;
- establishing acceptable confidence limits for the desired results;

- selecting a random sample frame and method - - for instance stratified sampling, cluster sampling - - and/or multiple applications of these;
- developing a questionnaire with expert advice from the client, end-users and those who will base their decisions on the research outcomes;
- making sure that the answers fit the questions - - not that the questions fit the answers;
- running a pilot study to refine procedures;
- incorporating lessons learned from the pilot study;
- establishing decision rules to deal with sampling and data quality issues *before* they arise;
- devising manuals to guide enumerators and analysts;
- ensuring consistent methods of data collection across the sample strata or clusters by means of training, handbooks and logbooks;
- training the trainers and emphasizing continuity and consistency in quality control;
- recognizing the importance of moments of demarcation in activities subject to analysis and measuring them with a keen eye to precision;
- handling the data with care with a view to preserving the scientific integrity of the overall methodology; and
- presenting the results with suitable disclaimers as and when appropriate.

All of this, of course, to be achieved on a research budget which is always - - by definition - - too tight, and within a timeframe that is inevitably too short! These are not easy tasks. But in general, the stricter the adherence to the pre-designed research approach, the more likely are the results to be usable with known *confidence,* while the *quality* of the resulting data will more likely be acceptable to researchers, clients and end-users as a whole.

Research design, sample randomness, enumeration accuracy and overall transparency are fundamental to the ability to positively answer the question: "if another researcher independently undertook to answer these same questions with these same data, could the original results be *replicated*"?

b. Designing the Sample Frame

i. Randomness versus system

Statistical analysis is used to make accurate inferences about the parent population under examination. A sample is selected and observed for this purpose in order to know more about the population as a whole. Difficulties arise because of ever-present variation among elements of the population, such that successive samples are usually different. The task of the researcher is to come to appropriate and reasonable conclusions about the population while bearing in mind the issues associated with sampling variation.

The researcher must cope with *two* key requirements in carrying out the analytical task. The first is to design a sampling frame and undertake the sampling so that it is representative of the population, and the second is to use the sample results to draw correct inferences about the population. Clearly, it is most difficult to achieve the second objective if the first is not well done. Inferences are unlikely to be accurate unless the sample has been taken competently. Therefore, the sampling procedure must be acceptable before attributing to the population results arising from an analysis of the sample.

In general, for samples to contain worthwhile and reliable information about the population, *each* unit of the sample must be selected at *random*, requiring that each element of the population has a known probability of appearing in the sample. If selection is left to the judgement of the researcher, his/her associates or interested third parties and they exercise their own choices, then the probability

surrounding these selections becomes unknown and the application of standard statistical procedures is confounded.[1]

A common procedure for ensuring randomness in a sample is to leave its drawing to a mechanical process, such as a random number generator, beyond the control of the research team and interested parties. This argument also applies when samples are stratified and/or clustered (as noted below). While we can admit that pure randomness is rarely attained in research practice, it is a fundamental aim of statistical research methodology, and invokes the mathematical model upon which the preponderance of statistical theory relies.

The closer the researcher can approximate randomness, the more nearly accurate will be the inferences drawn from the research study.

ii. Sample Size and Cost/Confidence Considerations

Given that procedures are in place to achieve a high degree of randomness in sample selection, a key issue is how large must be the sample size? If the sample size is too small – it may be too inaccurate to be reliable. Too large a sample may require the expenditure of too many resources while adding little extra information beyond what could be obtained from some smaller yet useful sample size. At issue is a determination of how large an error the researcher and his stakeholders can live with in the estimate. Moreover, the decision on an acceptable error also must take into account the uses to be made of the results and the potential cost and revenue consequences of different magnitudes of error - - for the client and other end-users who may ultimately be

[1] Non-probabilistic sampling procedures, such as *quota* sampling and *convenience* sampling, represent judgement samples, since they involve the selection of items in a sample on the basis of opinion, not randomness. When the population is small, or time/money will not allow collection of a random sample, or the study is strictly exploratory, then a judgement sample may be justified, but the statistical implications of abandoning random sample selection should be well understood, should be clearly flagged and should be expected to attract comment.

affected by the use of these results. This goes to the issue of *data quality* and the validity of inferences to be drawn from the data.

Put another way, the researcher should set up an allowable error, in terms of confidence limits, *before* designing the sample frame and deciding on the sample size - - overall, by strata and/or by cluster.

Once a decision of this type is made by the researcher and his stakeholders - - say that they are only willing to take a 5% chance that any error will exceed the allowable error in the sample mean - - then they have selected a 95% confidence limit for their study. With this decision in hand, there are then a number of ways to estimate what is an acceptable sample size for the research undertaking. These require bearing in mind prior information (from earlier studies or related populations), results of pilot studies, statistical methods for complex sampling, and budget constraints. Essentially, some advance estimates are needed of both the relative costs per unit of collection and expected variance in the strata and/or cluster under observation; rough estimates will often give sample size indications that are acceptably close to an optimum allocation.

Simple random sampling of a large population may be difficult to achieve, not least because it might prove very costly. More practical procedures may be employed recognizing that they will also be more restrictive and open to discussion and dispute. Among the methods that may be employed are:

- *Systematic sampling* – choosing a random starting point and selecting every *Kth* element to be an item in the sample;
- *Stratified sampling* – dividing a population into homogeneous groups or classes as *strata.* Each stratum is then randomly sampled;
- *Cluster sampling* – where the parent population is sub-divided into groups so as to design an efficient sample. These *clusters* ideally have the same characteristics as the parent population and are then randomly sampled.

iii. Stratified Sampling

The best method of selecting strata is to find groups *with a large variability between strata, but only a small variability within the strata.* Choice among and within these groups may then be based on a random selection method.

A *proportional* stratified sampling plan would use items from each stratum in proportion to the size of that stratum, to ensure that each stratum in the sample is weighted by the number of elements it contains, relative to the parent population. A *disproportionate* stratified sample may be an efficient device, if it is known that a particular stratum contains a high degree of variability that will yield a maximum amount of information for a given amount of research effort. The *weighting* of such results should reflect the proportionality or dis-proportionality of the sample strata.

iv. Cluster Sampling

The objective here is to obtain observations such that there is *little variability between clusters, but a high degree of variability - - representative of the parent population - - within each cluster.* If each cluster is assumed to be representative of the parent population, then the characteristics of the population can be estimated by *randomly* picking a cluster and *randomly* sampling elements within this cluster. Two-stage random sampling within a cluster is often effective and efficient.

v. Multiple and Sequential Sampling

When budget constraints impact sample design, it is often useful to frame a pilot study wherein only a small number of items are used to represent the parent

population. If high variance is uncovered, then it may be valuable to undertake multiple-stage sampling, especially when the parent population is large.

The advantage of sequential sampling is reflected in the savings that result when fewer items than usual must be observed, say from a cluster within a cluster.

vi. Choice of Sample Methods

Selection from among several types of random sampling plans depends on the researchers prior knowledge of the parent population (and the results of previous research); namely the likely validity of *stratified* and *cluster* sampling to achieve efficient and confident parameter estimates of the population. Issues to address include:

1) What is the most cost effective method to collect samples that best ensures that the samples are representative of the parent population?
2) How reliable are the inferences and conclusions about the parent population likely to be drawn from sample information?
3) What are the best ways of describing sample information usefully while not-overstating the predictive power of the results?

It is the decisions resulting from incorrect inferences that can be costly, not the incorrect inferences themselves. Thus, there is a requirement on behalf of the client and stakeholders that the sampling methods employed minimize the cost of making an incorrect decision, or error.

At the end of the day, a primary objective of sample design is to balance the potential costs of making an error against the costs of undertaking sampling.

vii. Trial Sample Testing and Lessons Learned

Pilot studies, which use the overall research design, sampling methodology and questionnaire set-up, yield valuable insights. Discussion of pilot results with clients and stakeholders often refines the issues, tightens the project focus, and sharpens the statistical tools. It also ensures a higher degree of stakeholder acceptance of the research end results. Moreover, information on sample statistics gleaned from the pilot can be very helpful in deciding on the optimal overall sample size to achieve best value for money within the confidence limits acceptable to the clients and stakeholders. It also allows the researcher to test the decision – rules adopted concerning data quality, data inclusion/exclusion, and analytical methods. In summary, results from a pilot or trial sample usually reveal potential pitfalls in avoiding bias in the final results. Studies which neither explain the choice or and rationale for one of these methods of sampling, nor provide the target confidence limits should be viewed with concern. Only if the study is exploratory, or its conclusions regarding the parent population unnecessary, should these rigorous standards be relaxed,

IV. Data Collection Issues

i. Questionnaire design – "Answers to Questions" v. "Questions made to fit the answers."

It almost goes without saying that questionnaire design is very important to achieving useful results. Clients and stakeholders should be consulted. Badly designed questions elicit difficult to interpret answers. Any Canadian will give you plenty of examples concerning questions about "Quebec Separation" – how distorted do you want the answers to be?! Pilot surveys usually reveal unexpected questionnaire responses due to a poorly framed interrogatory. Re-wording will usually remove potential response biases. Perhaps the most

alarming approach is to design the questions *after* the survey has been conducted (for another purpose) and attempt to make "the questions fit the answers" in some fashion. Since the enumerators *did not know* these post-survey questions, how could they exercise any quality control over what was being measured *ex.post*, or recognize any data deficiencies – random or endemic? This "cart before the horse" procedure leaves in tatters all the issues of errors in data collection, data exclusion/inclusion and decision rules, since the relevant questionnaire and its objectives were unknown to the research designers and the enumerators *until after* the data had been collected.

For example, none of the questions that Mr. Raymond answers in his cost study were posed to enumerators.[2] All answers recorded were based on a different "unspecified" set of criteria. This is an instance of a researcher fitting the observation tallies, i.e. "the answers" into a new set of questions – the six cost categories. How well he has done this is a matter of conjecture and divination. It appears as if the researcher is doing the complete exercise *backwards*. For reasons earlier discussed, it is not possible to offer any level of confidence in the sample or the parameter estimates arising therefrom.

A typical cost study questionnaire design would clearly specify the activity to be observed and the *points at which it begins and ends*. No such questionnaire exists for these data nor are there any relevant observational standards.

ii. Engineering estimates versus cost estimates

There is a remarkable difference between quantifying the number of sufficient time and motion segments for an *engineering study* of time use, versus quantifying the appropriate number of routes, by route type to develop a

[2] See L. Raymond, Direct Testimony on behalf of the United States Postal Service before the Postal Rate Commission, Washington, D.C. 20268-0001, Docket No. R2000-1, USPS-T-13 and his Library Reference to USPS-LR-1-163, Engineered Standards Database.

statistically valid sample for purposes of cost estimation and rate-making decisions.

Industrial Engineers (I.E.) use sampling techniques to measure distinct pieces of work, which are not necessarily the same as those used in cost estimates. The I.E. advantage, from a statistical perspective, is that the individual errors are not cumulative, so as estimates are added together, provided no inherent bias exists, the total error reduces. This enables them to measure individual work elements to a lower degree of accuracy than is called for in statistical cost studies.

In addition, I.E. estimates often exclude any time measure for inefficiencies or low productivity. As cost estimates capture these two elements it is essential that the sampling for cost studies be constructed so as to avoid any bias from these factors. The various aspects and distinct elements of load time cannot be merged together - - as in I.E. - - without recognizing that there will be significant losses in accuracy and variability for cost estimation purposes.

iii. Enumeration methods

The method by which Mr. Raymond conducted his enumeration of data for the Engineering Standards study was generally acceptable for that species of study. A systematic time interval occurring frequently enough to minimize the affects of regular break times, cyclical activities, was measured. However, Mr. Raymond had his enumerators also doing a variety of other activities, such as taking video pictures, recording paces walked, at the same time as tallying the observations. Tallies were given a lower priority than these other activities, with the enumerator entering the information from memory some minutes later. This procedure is unacceptable in a typical cost estimate study because potentially it magnifies the probability of error.

iv. Training manuals and log-books

Mr. Raymond has consistently said that no training manuals for his data collectors exist and that the only logs kept were the notes made by the enumerators on the daily records that are buried in volumes of other raw data sheets.

In a typical cost study all data collectors would pass the same training course to ensure consistency between enumerators, and each would commence work with a training manual to use as a reference document during the study. A logbook is normally kept in which work times, numbers of observations and anomalies, are recorded - - together with any changes that are made to the observations after-the-fact. These manuals and logs are key elements of any well-designed statistical survey.

v. Training the trainers

Where it is necessary for more than one trainer to be involved in training the enumerators, it is essential to identify the key points that must be focused on to ensure subsequent consistent observations by the various trainees, e.g. the load time begins at the moment that the letter carrier's feet stop moving at the end of a walk and ends at the moment that the foot is lifted to start away from a stop.

It should also be remembered that the majority of the training for Mr. Raymond's study focused on factors of importance to the Engineering Study, i.e. video training, how to enter the information with the bar code reader, how to identify the various activities and types of mail receptacle rather than maintaining the consistency and accuracy of cost-related data collection.

vi. Training the enumerators

Enumerators all need to be trained to the same observational standards if data are to be consistent across strata or clusters. In Mr. Raymond's Engineering Study a variety of different training methods were used, which were certainly acceptable for the work being undertaken – observations of the work activities for industrial engineering time estimates, frequencies, and percentage occurrence of various different activities. This training however, was inconsistent and woefully inadequate for data collectors working on a statistical study to allocate costs.

vii. Decision Rules on Data Acceptance

Elimination of any sampled data should only occur in extremely vexed cases, e.g. violent weather, power failure and the like, and in accordance with pre-determined decision rules. Excluded data are usually presented for review by clients and to other researchers attempting to replicate the study results. These procedures are not necessarily adhered to in Engineering Studies. They appear not to have been subscribed to fully by Mr. Raymond when using engineering data to make cost estimates.

viii. Data Quality Maintenance

Throughout this discussion, the emphasis has been on efficiently obtaining usable research results, without sacrificing data quality. Researchers, clients and stakeholders all have interests in getting the best (accurate) and most up-to-date sample statistics concerning the key cost parameters in the parent population, in this case the route operations of the United States Postal Service.

Certainly, there are many examples where the budget or available time-frame has driven the sample size and the confidence in the results obtained has suffered accordingly. It is however, critical to recognize that decisions that have far-reaching cost and revenue implications may not be best served if they are based upon results obtained from subsidiary studies in which corner-cutting considerations have perforce led to a series of deviations from "best-practice" statistical methodologies for cost studies.

Indeed, the Data Quality Study (1998) emphasized the importance of improving *methodological standards* rather than abandoning them. As world leaders in postal ratemaking practice, the Postal Rate Commission continues to require the highest standards of research performance – given the available resources – to enhance its deliberations and inform its decision-making.

IV. Are any data better than no data?

i. The need for new USPS cost data.

There is general agreement about the long-standing need to up-date and improve the USPS cost data. This need was highlighted in several parts of the Data Quality Study which unearthed "rules of thumb" dating back to the 1920's which are still being applied in the twenty-first century. Moreover, the client (USPS) and the stakeholders (the mailers) recognize that the familiar cost parameters dating from the past two decades have been overtaken by technical change, productivity shifts, traffic patterns, work methods and many other extraneous forces. Nevertheless, any shifts away from these long established "traditional" cost parameters should be gradual, well founded and widely "bought-into" by both the USPS and the stakeholders.

ii. Quality Data for Quality Decisions

In the balance, there is far too much revenue/expenditure at stake for ratemaking decisions to be based on inadequate new data or flawed research procedures. A robust and scientifically defensible innovative cost study needs to be done and the USPS needs to find the budget to commission it, as a matter of priority. Band-Aid solutions and half measures are simply not acceptable - - what would "Big One" lottery ticket holders have thought if their numbers were not included in the recent $360 million lottery drawing?! All the data from the parent population must be available for a random sampling process and professional vetting must be done when the research is designed, implemented and reported upon.

iii. What the Data Quality Study said about Letter Carrier Costs

The Data Quality Study, commissioned jointly by the PRC, USPS and the General Accounting Office, was quite specific in its recommendations with regard to Delivery Costs. Pages 53 to 56 of the Technical Report #4 are provided in an Appendix. These recommendations include:

- Redesign and update the relatively old and highly imprecise Delivery special studies.
- Review the data being developed by the Delivery Re-design project to assess if this information is a possible *long-term* (my emphasis) replacement for IOCS and some special study data.

These imply an extensive discussion of what the Re-design project was doing and what the Postal Service should do with it. The recommendation was qualified with the following important statement: "Reviewing this data now can also allow the rate making forces within the Postal Service to impact the quality of data to be collected in this new system."

It most certainly did not say: "Dig into what has already been done and see if you can fit some previous observations into something to replace the special studies." In fact no-one could be better placed than A.T. Kearney to understand whether the work by Mr. Raymond - - already completed when reviewed by the Data Quality Study - - could be used for rate-making, since A.T. Kearney was responsible for both the Data Quality Study and the Engineering Study managed by Mr. Raymond. The forward-looking nature of the suggested solution speaks volumes.

iv. Is the Engineering Study data better than no data?

Great caution should be exercised in considering whether to use the Engineering Study data results as a basis for developing new cost results guiding ratemaking. There is no criticism here of the Engineering Standards study *per se*. However, there is extreme reticence to use the reworked data from this study for purposes for which it was never designed or collected.

No confidence levels can be ascribed to these data because no sample design was made. The best we can say is that we have information on a number of pre-selected postal stations. How these relate to the total universe we are unable to say. The resulting cost data, calculated by Mr. Baron, may be indicative and even enjoy a degree of accuracy, but no one can say with any *confidence* what value to put on these sample estimates because of the unacceptable fashion in which they were obtained. The one thing that these results do achieve, is to underscore how important it is to undertake a transparent, replicable and scientifically defensible study of relevant cost parameters in the USPS route system at the earliest opportunity.

CERTIFICATE OF SERVICE

I hereby certify that I have this date served the foregoing document upon all participants of record in this proceeding in accordance with the Commission's Rules of Practice.

Anne R. Noble

Washington DC
May 30, 2000

DECLARATION
OF
KEITH HAY

I declare under penalty of perjury that the foregoing Direct Testimony of Keith Hay on Behalf of the Magazine Publishers of America, Inc. et al. (MPA-T-4) was prepared by me and that if called upon to testify under oath, it would be my testimony.

Keith Hay

Executed: July 10, 2000.

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, DC 20268-0001

Postal Rate and Fee Changes, 2000 Docket No. R2000-1

DESIGNATION OF WRITTEN CROSS-EXAMINATION
OF MAGAZINE PUBLISHERS OF AMERICA
WITNESS KEITH HAY
(MPA-T-4)

Party	Interrogatories
Newspaper Association of America	NAA/MPA-T4-2-3
	USPS/MPA-T4-2
United States Postal Service	USPS/MPA-T4-1-7

Respectfully submitted,

Cyril J. Pittack
Acting Secretary

INTERROGATORY RESPONSES OF
MAGAZINE PUBLISHERS OF AMERICA
WITNESS KEITH HAY (T-4)
DESIGNATED AS WRITTEN CROSS-EXAMINATION

Interrogatory	Designating Parties
NAA/MPA-T4-2	NAA
NAA/MPA-T4-3	NAA
USPS/MPA-T4-1	USPS
USPS/MPA-T4-2	NAA, USPS
USPS/MPA-T4-3	USPS
USPS/MPA-T4-4	USPS
USPS/MPA-T4-5	USPS
USPS/MPA-T4-6	USPS
USPS/MPA-T4-7	USPS

NAA/MPA-T4-2. Please refer to your testimony at page 8, line 13 through page 9, line 29.

a) Did you analyze the sample sizes of Witness Raymond's ES study? If so, please provide a detailed account of both your approach and your findings.
b) In you opinion, what are acceptable sample sizes for a study as Witness Raymond's ES study?
c) Do you have any recommendations for selecting allowable error or confidence limits for cost estimation for ratemaking purposes?
d) At pages 27-28 of her testimony, MPA Witness Crowder suggests that the "unweighted sampling ratios" resulting from Witness Raymond's ES study invalidate his sample. In your opinion, what are adequate unweighted sampling ratios?

Response:

(a) I am assuming in this instance that what you describe as the Raymond ES study is the testimony and library references provided by witness Raymond to this rate case. I did not analyze sample sizes in Witness Raymond's Engineering Standards (ES) Study because of the non-scientific procedures used to select the sample and their apparent lack of overall randomness. If random procedures are not adhered to throughout, the sample size is largely meaningless.

(b) Please see pages 8 through 10 of my testimony and the answer to part (c) below.

(c) If the chosen random sample size is (say) 1100, then the survey research industry standard is such that the results may be considered accurate to within three point zero (3.0) percentage points, 19 times out of 20, of what they would have been if the entire population had been polled. The margin of error will be larger within regions and for sub-groupings of the survey population. Data are often statistically weighted to ensure the sample's regional and other characteristics reflect those of the actual universe population according to previously known census-type data.

(d) Adequate sampling ratios are those that allow the random sample to reflect the spatial and other characteristic mixes of the universe under investigation. See also answer (c) above and my testimony on page 10, lines 7 to 14.

NAA/MPA-T4-3. Please refer to your testimony at page 14, lines 10-15, where you state "[i]n addition, I.E. estimates often exclude any time measure for inefficiencies or low productivity. As cost estimates capture these two elements it is essential that the sampling for cost studies be constructed so as to avoid any bias from these factors. The various aspects and distinct elements of load time cannot be merged together—as in I.E.—without recognizing that there will be significant losses in accuracy and variability for cost estimation purposes."

a) Please identify any instances where Witness Raymond's ES study excluded time measures for inefficiencies or low productivity.
b) Please assess the specific bias form these tow factors inherent in Witness Raymond's ES study.
c) Please identify any instances where Witness Raymond's ES study merged together "various aspects and distinct elements" of load time.
d) Please provide a specific example (from either Witness Raymond's ES study or elsewhere) of the significant loss in cost estimation accuracy or variability from industrial engineering.

Response:

I am assuming in this instance that what you describe as the Raymond ES study is the testimony and library references provided by witness Raymond to this rate case.

Engineering standards studies, of a generic nature, are designed to produce results for performance management and staffing requirements, and as such their measurement methods may not coincide with the requirements of measurement in a cost study. For instance, it may be satisfactory for engineering standards purposes to calculate a time for walking one pace, a time for sorting one letter, a time for mounting one step, and a time for depositing letters in a box. As discrete units of time they can be reconstructed into a delivery time by counting the number of paces, counting the letters, counting the steps, and knowing the type of receptacle in use. For costing purposes we randomly sample complete actual operations.

(a)-(d) As the work presented by Raymond was a small part of a larger engineering study, (itself part of the Delivery Redesign Program), and had the purpose of identifying the delay factors, it does not exclude time measures for inefficiencies, nor does it exclude low productivity. As such none of *these* factors create any *additional* biases. However, as witness Crowder has said in her testimony, there is apparently confusion over what non-productive activities were included, and should have been included, in the *ex post* load time assessment.

RESPONSE OF MAGAZINE PUBLISHERS OF AMERICA WITNESS HAY TO INTERROGATORIES OF UNITED STATES POSTAL SERVICE (USPS/MPA-T-4-1-7)

USPS/MPA-T4-1. Please provide a complete listing of all publications that you have authored or co-authored.

Response:

Please see attached partial list of publications and reports.

Keith A. J. Hay (written work, partial listing)

REPORTS, BOOKS AND MONOGRAPHS:

- *Using the Post Office as a Development Tool* (with David Rawnsley), presented at the 8th "Conference on Postal and Delivery Economics", Vancouver, Canada, June 2000.
- *Issues of Statistical Cost Studies in the United States Postal Service*, Testimony before the US Postal Rate Commission, Washington, D.C., May 2000.
- *Canadian International Trade with the USA, Relative Trade Growth under NAFTA: A Comparative Time Series Study*, Japan Ministry of Foreign Affairs, March, 2000.
- *Notes on E-Business, Knowledge Management, and Developing Countries*, CIDA, Africa Branch, January 2000
- *Economic Growth, Aid Effectiveness and Poverty Reduction in Sub-Saharan Africa*, CIDA Africa Branch, Jan. 2000 (with Neil Saravanamuttoo)
- *Challenges and Opportunities for Guyana and the Caribbean, Recent Trends in Globalization and the Information Revolution*, The First International Management Conference in Georgetown, Guyana, October 1999
- *Canada-US Auto Pact, Implications for Japan at the WTO*, Japan Ministry of Foreign Affairs, March 1999.
- *A Model for the Postal Industry in a Developing Economy* (with David Rawnsley and A. Robinson), presented at the 6th "Conference on Postal and Delivery Economics", Berne, Switzerland, June 1998.
- *Data Quality Study*, US Post Office, Postal Rate Commission, December 1998 (with Peter Wayne).
- *Blainville Horse Show Study*, Blainville Horse Show, March, 1998.
- *Prospective Issues on North American Automotive Trade*, Embassy of Japan, Ottawa, Canada, September, 1998 (with P. Kanagaratnam)
- *Canada-U.S. Trade Relations*, A Success Story of Dynamic Strategic Management, Embassy of Japan, Ottawa, Canada, May, 1998.
- *Economic Impact of a Large Horse Show*, Ontario Horsemen's Association, September 1997.
- *Assessment of Impact of Rural Maintenance Program*, CARE-Bangladesh, December, 1997.
- *Western Grains R&D and the International Agricultural R&D System*, Agriculture Canada and CIDA, Ottawa, 1997 (with Ellen Hols).
- *China (Sichuan) Telephone Project Financial Simulation Analysis*, Asian American Telecommunications Corporation (AAT), Columbus, Ohio, USA, 1996.
- *Implications of the Growth in Asia Trade and Traffic for Transportation Safety and Security: Satellite Navigation and Communications*, (with Ellen Hols), Asian Pacific Economic Cooperation Group, (APEC) Manila, 1996.
- *China Transport Sector Programming Options Paper*, (with Vaughan Corbett and Ellen Hols), CIDA China Desk, November 1996.
- *Canadian Export Opportunities in Asian Housing Markets*, (with Ellen Hols), Asian Pacific Economic Cooperation Group, (APEC) Manila, 1996.
- *Impact of Various Size Horse Shows on Economies in Canada*, (with Ellen Hols), Professional Horsemen's Association in Canada, November 1996.
- *Vietnam Telecoms Project Financing Simulation Analysis*, (with Ellen Hols), PortaCom Wireless, Los Angeles, Ca., USA, 1996.
- *Feasibility of Producing a Combined Annual Report for CIDA*, (with E. Hols and T. Gebre-Kidan), CIDA, 1996
- *Macro Economic Considerations of Development Lines of Credit and Counter-Part Funds* (Goss Gilroy), CIDA, 1996.
- *Review of Infrastructure Services Evaluation*, CIDA Performance Review, 1996
- *Needs Assessment Study, Comptroller General of Peru*, (with O. Blanchet and R. Lefebvre), PAR Group, Lima, Peru, 1996.
- *Methodology for Economic Monitoring in Ghana*, Canadian International Development Agency, Africa Branch, 1995
- *Infrastructure for Development in Asia: Strategic Programming Options*, Canadian International Development Agency, Asia Branch, 1995.
- *Guyana Technical Assistance, Seminar & Workshop*, (team leader) Canadian International Development Agency, 1995.
- *Evaluation of the Co-operative Republic of Guyana: Structural Adjustment Credit*, The World Bank, 1995-96.
- *Report on Revising the Canadian Bank Act and Supervision for Financial Institutions*, Department of Foreign Affairs, Tokyo, Japan, 1995.
- *Strategic Partnering Project: China Economic Benefits Study*, GEC Alsthom Electromechanical, Montreal, 1995.
- *Sources of Economic Instability in the Americas*, Canadian International Development Agency, Americas Branch, 1995.
- *Support to Public Expenditure Report: Methodology for Economic Monitoring in Ghana*, for Canadian International Development Agency, Africa Branch, 1995.
- *Infrastructure for Development in Asia: Strategic Programming Options*, Canadian International Development Agency, Asia Branch, 1995.
- *Guyana Technical Assistance, Seminar & Workshop*, Canadian International Development Agency, 1995.
- *Evaluation of Co-operative Republic of Guyana: Structural Adjustment Credit*, The World Bank, 1995.
- *Evaluation of Guyana Community Development Fiduciary Fund*, collaboration with Frans Aarsma, Dada International, 1995.
- *Strategic Partnering Project: Economic Benefits Study*, GEC Alsthom Electromechanical, 1995.
- *Canada Aid and Trade: Institutions, Policies and Results*, Canadian International Development Agency, Policy Branch, 1994.
- *Electric Power Generation in ASEAN: Market Opportunities*, Foreign Affairs Canada, and Canadian Power Systems Export Promotion Group (CAPSEP), 1994.
- *Capital Markets and Financing of Power Equipment Exports and Services to ASEAN*, Foreign Affairs, Canada and Canadian Power Systems Export Promotion Group (CAPSEP), 1994.

- *Economic and Strategic Pre-Feasibility Study: Vietnam*, Canadian International Development Agency, Asia Branch, Vietnam Program, (CIDA), 1994.
- *Structural Adjustment Programs in Sub-Saharan Africa*, Canadian International Development Agency (CIDA), 1994.
- *Economic Reform in Four Southern Africa Countries and Prospects for Economic Integration in the Region*, Canadian International Development Agency, (CIDA), 1994.
- *Executive Summaries and Recommendations: Donor Assistance in the Context of Structural Adjustment in Southern Africa*, Canadian International Development Agency (CIDA), 1994.
- *Tanzania: Recent Performance and Prospects*, Canadian International Development Agency (CIDA), 1994.
- *Lessons Learned: CIDA in Jamaica*, Canadian International Development Agency, Audit and Evaluation Division, (CIDA), 1994.
- *Current Situation and Outlook for Canadian Aid Policy*, Embassy of Japan, 1994.
- *Capital Markets and Financing of Power Equipment Exports and Services to ASEAN*, Foreign Affairs, Canada and Canadian Power Systems Export Promotion Group (CAPSEP), 1994.
- *Hydro Electric and Transmission Distribution Equipment Manufacturing A Strategic Asset For Canada*, Consortium "A" & "B", Hydro Electric and Transmission Distribution Equipment Manufacturers, 1994.
- *Electric Power Generation in Major International Markets: Business Opportunities*, Emerson Electric Canada Ltd., 1994.
- *Poverty Reduction and the Bangladesh Garment Export Sector*, Canadian International Development Agency, Ottawa, 1994 (with Angela Keller-Herzog and Hillary Hey).
- *Trade, Investment and Development of the People's Republic of China*, Canadian International Development Agency, 1993.
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- *CIDA's Balance of Payments Support Program for Ghana: Evaluation of Support Group Activities, Structural Adjustment Program and Development Lines of Credit*, Audit and Evaluation Division, Canadian International Development Agency, June 1993 (with Angela Keller-Herzog).
- *Economic Restructuring in Southeast Asia*, Canadian International Development Agency, 1993 (with Angela Keller-Herzog and Christine Thompson).
- *Dispute Settlement Mechanisms: Lessons for Canada-Japan Commercial Relations*, The Canada-Japan Trade Council, 1993 (with Ish K. Singhal).
- *Thailand, Mexico and the North American Free Trade Agreement*, The National Economic and Social Development Board (NESDB), Bangkok, Thailand, 1993 (with Christine E. Thompson and Angela Keller-Herzog).
- *Canadian Environmental Capabilities Survey*, Canadian International Development Agency, Ottawa, 1993 (with C.G. Smallridge & Associates).
- *DAC Review of Japan's Development Cooperation*, Canadian International Development Agency, Ottawa, 1993.
- *Economic Benefits Study Wuqu Pit Zhou*, Canadian Hydropower Consortia "A" and "B", June 1993.
- *Canada-US Trade Dispute Settlement Mechanism*, Government of Japan, 1993.
- *Impact of Liberalizing the MFA For Bangladesh on Specific Canadian Clothing Subsectors*, Canadian International Development Agency, Ottawa, 1992 (with David R. Avon).
- *Some Issues Concerning CIDA's Approaches to Regional Planning in East Asia*, Asia Branch, Canadian International Development Agency, August 1992.
- *Canada-Japan: The Export-Import Picture 1992*, Canada-Japan Trade Council, Ottawa, 1992 (with Colin A. Saravanamuttoo).
- *Impact Study of the Multi-Fibre Arrangement (MFA) on Bangladesh*, Canadian International Development Agency, Ottawa, 1992 (with Soc Thinn).
- *Economic Study of the Canadian Sheep and Wool Industry*, Agriculture Canada, Ottawa, 1992.
- *Business Opportunities in Poland: A Guide to Agricultural Ventures*, EAITC, Ottawa, 1992, (with Armando Peschard-Sverdrup and Sheldon I. Polowin) pp 293
- *Financing Future Exports of Canada's Electrical Power Equipment Industry, in Energy Studies Review*, (Volume 4, Number 2), McMaster Institute of Energy Studies, McMaster University, Hamilton, Canada, 1992 (with C.A. Saravanamuttoo), pp 161-180.
- *Financing Future Exports of Canada's Electrical Power Equipment Industry*, Canadian Power Systems Export Promotion Group, Ottawa, 1992, (with C.A. Saravanamuttoo).
- *Environmentally Sustainable Technology Transfer of Coal-Fired Energy Technologies: Canada and Asia, in Energy Studies Review*, (Volume 3, Number 2), McMaster Institute of Energy Studies, McMaster University, Hamilton, Canada, 1991 (with C.A. Saravanamuttoo and D.R. Avon), pp 179-183.
- *Report on the Potential and Mechanisms for Coal-Based Electrical Generation Technology Transfer Project*, Energy, Mines and Resources Canada, Ottawa, 1991 (with C.A. Saravanamuttoo and D.R. Avon).
- *Manufactures: How Canada Got the Goods for Japan?* Canada-Japan Trade Council, Ottawa, 1991.
- *Aid to South Asia in the 1980s: Canada's Role and some Implications for Trade"*, in N.K. Choudhry, ed. Canada and South Asia Development: *Trade and Aid*, E.J. Brill, Leiden, 1991, pp.78-96.
- *Canadian Access to Funding for ASEAN Projects at International Financial Institutions*, ASEAN-Canada Business Council, Ottawa, 1990.
- *Doing Business in ASEAN: A Guide to Accessing Offshore Sources of Funding*, (with S. Polowin and A. Peschard), ACBC, Ottawa, July, 1990.
- "*Factores Determinantes y Efectos Multiplicadores de la Modernizacion del Subsector de la Agricultura*", capitulo 10, en C. Pomareda and J. Torres, eds. Modernizacion de la Agricultura en America Latina y el Caribe, IICA, San Jose, Costa Rica, 1990 (with M.M. Lynch).
- "*El Rol de la Modernizacion de la Agricultura en el Desarrollo Economico*", en Procesos de Modernizacion de la Agricultura en America Latina y el Caribe, IICA, San Jose, Costa Rica, 1989 (with M.M. Lynch).

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- *Evaluation of Debt Management Recording System: Sri Lanka and Papua New Guinea*; Commonwealth Secretariat, London, 1989 (with two other authors).
- *Evaluation of Debt Management Recording System: Papua New Guinea*, Commonwealth Secretariat, London, 1989 (with two other authors).
- *Expanding Markets, Diminishing Shares? Canadian Food Sales to Japan*, Ottawa, 1989 (with V.R. Fiander).
- *Canada and Japan: The Money Business*, Ottawa, 1986, (with J.A. Hawkins).
- *Tourism: The Canada-Japan Pattern*, Ottawa, 1986, (with M.O. Lovatt).
- *Canada and Korea: New Partners*, Ottawa, 1985 (with M.O. Lovatt).
- *Canada's Future Technological Ties with Japan*, Ottawa, 1985.
- *Canadian Forest Products for Japan*, Ottawa, 1984 (with S.R. Hill).
- *Canadian Food for Japan*, Ottawa, 1983, (with M.O. Lovatt).
- *Canadian Coal for Japan*, Ottawa, 1982, (with S.R. Hill and S.S. Rahman).
- *Canada-Japan and the Pacific Community*, Ottawa, 1981, (with P. Price).
- *Canada-Japan: The Export-Import Picture*, Ottawa, biennially on various issues, (with V.R. Fiander/M.O. Lovatt/S.R. Hill).
- *Japan's Industrial Development*. Testimony before Senate of Canada, Standing Committee on National Finance, 23rd Proceedings on Examination of Government Policy and Regional Disparities (Main Estimates 1980-1981). Issue No. 30, March 31, 1981.
- *Canadian Perspectives on Economic Relations with Japan*, Montreal, 1980.
- *Canada-Japan Trade and Investment*, Ottawa, 1979, (with S.R. Hill).
- *Friends or Acquaintances? Canada and Japan's Other Trading Partners in the Early 1980s*, Montreal, 1978.
- "*Canada's Economic Ties with Japan*", in Hillmer, N. and Stevenson, G., Foremost Nation, Toronto, 1977, pgs. 268-293.
- *Japan: Challenge and Opportunity for Canadian Industry*, Montreal, 1971 (translated into Japanese and published, Tokyo 1973).

OTHER ARTICLES:

- "*Financing Future Exports of Canada's Electrical Power Equipment Industry*", in Energy Studies Review Vol. 4, No. 2, 1992, pp. 161-180.
- "*Aid in South Asia in the 1990s: Canada's Role and some Implications for Trade*", in N.K. Choudhry, ed. Canada and South Asia Development: Trade and Aid, E.J. Brill, Leiden, 1991, pp.78-96.
- *Canadian Exports to Japan: 1989*, presented at the Canada-Japan Business Cooperation Conference, Hiroshima, Japan, May, 1990 (with K. Pringsheim, published in Proceedings)
- "*ASEAN and the Shifting Tides of Economic Power at the End of the 1980's*", in International Journal, XLIV, 1989, pp. 640-659.
- And more than forty other articles published on topics ranging from money and macro economic stabilization, to education and health, to international economic relations, and industrial policies.

OTHER ACTIVITIES:

- *Consultant* to the numerous young high technology companies in Ottawa, Toronto and San Jose, and to the Canadian International Development Agency, Canada Post Corporation, US Postal Service, Government of Japan, Canada-Japan Trade Council, Bank of Canada, Economic Council of Canada, Agriculture Canada, Fisheries and Oceans Canada, External Affairs Canada, Inter-American Institute of Agriculture, Commonwealth Secretariat, Asian Development Bank, World Bank and other Canadian and international agencies as well as private sector groups.
- *Financial Advisor, TeamCast.Com Inc.*, a software company specializing in IP-based (Internet Protocol) application development. TeamCast.Com is focussed exclusively on web-enabled knowledge management and group collaboration. The company has developed a dynamic product called TeamCast. TeamCast is an IP-based product that facilitates knowledge management across small to large organizations over the Internet or corporate Intranets. The company delivers its product in the following three ways: TeamCast Web Service; TeamCast Enterprise Software; TeamCast Corporate Hosting Service.
- *Financial Advisor, Video Telcom International Inc.*, a revolutionary communications company in the business of manufacturing and marketing high bandwidth Optical Switches and Video Communications technologies. Video TelCom's Optical Switch technology makes it possible and economically viable to transfer an optical signal from one end of a network to the other by using the properties of the light wave itself to route the transmission along different pathways through the network. The technology can save hundreds of billions of dollars spent annually by the telecommunications companies on fiber optic installations and switching equipment to increase their market share and enhance the capabilities of their networks for the data and video transmission generating new revenue streams.
- *Financial Advisor, Zivex Technology Solutions Inc.*, an information technology (IT) solution provider to small businesses. Zivex has developed a solution to provide small businesses access to the same set of tools and level of support commonly available to most large businesses. It is a complex technology infrastructure consisting of servers, communications hardware and software required to offer a complete IT enterprise management system.

Earlier activities include, among others:

- *Expert Advisor and Managing Editor:* Economic and Strategic Pre-Feasibility Study: Vietnam, Canadian International Development Agency, Asia Branch, Vietnam Program, (CIDA), 1994.
- *Project Director:* Trade, Investment and Development of the People's Republic of China, Canadian International Development Agency, China Desk, (CIDA), 1993.
- *Project Director:* Electric Power Generation in ASEAN: Market Opportunities, Foreign Affairs Canada, and Canadian Power Systems Export Promotion Group (CAPSEP), 1994.
- *Project Director:* Capital Markets and Financing of Power Equipment: Exports and Services to ASEAN, Foreign Affairs, Canada and Canadian Power Systems Export Promotion Group (CAPSEP), 1994.
- *Project Director:* NINA: Project Financing Study, Canadian Hydropower Consortia "A" and "B", 1993.
- *Project Director:* Economic Benefits Study: NINA, Canadian Hydropower Consortia "A" and "B", 1993.
- *Project Director:* Economic Analysis of the Canadian Lamb and Sheep Industry, Agriculture Canada, 1991-1992.
- *Project Director:* Prospects for Thailand's External Trade, NESDB, Thailand, 1991-1992.
- *Project Director:* Competitiveness of the Canadian Power Supply Export Sector, CAPSEP, Montreal, 1991.
- *Project Director:* Poland: Agri-Business Joint Venture Assessments, External Affairs, 1990-1991.
- *Rapporteur:* Round Table on Direct Investment from Japan, External Affairs and International Trade Canada. Report pub. March 1991.
- *Team Leader:* Report on the Potential Mechanisms for Coal-Based Electrical Generation Technology Transfer, CANMET, 1991.
- *Project Director:* Five Studies of Non-Traditional Exports from Debt-Burdened Countries in Latin America, OAS, 1989-1990.
- *Project Director:* Costa Rican Economic Development Program, CIDA, 1990.
- *Team Leader:* Philippines Industrial Survey of Seven Subsectors, (agroprocessing, fisheries, furniture, jewellery, autoparts, industrial chemicals, and footwear), CIDA, 1989-1990.
- *Sole Consultant:* Politicas Macroeconomicas y Sectoriales y el Desarrollo Agricola, Guatemala, World Bank - SIECA - IICA, 1989.
- *Team Leader:* Design of the CIDA Modern Sector Assistance, Philippines, CIDA, 1988.
- *Project Director:* Philippines Industrial Development, CIDA, 1988.
- *Project Director:* New Role of Japan in International Assistance, CIDA, 1988.
- *Project Director:* ASEAN Technology Transfer, CIDA, 1987.
- *Team Leader:* Canadian Supply Capabilities in MLE Development, Volume III, Phases B&C, CIDA, 1987.
- *Team Leader:* Gatineau Park User Pay Policy Analysis, NCC/DSS, 1987.
- *Project Director:* Market Potential for Electrical Power in Thailand and Malaysia, AECL, 1987.
- *Team Leader:* SPX Courier Ground and Air Rates: Analysis and Discussion, CPC, 1987.
- *Team Leader:* Canada-US Free Trade: An Analysis of the Impact and Implications, Embassy of Japan, 1987.
- *Project Director:* Role of US Independent Truckers in US/Canada Transborder Trucking, Transport Canada, 1987.
- *Team Leader:* Canada's Business Relations with Non-Industrialized Asia, with Special Reference to International Trade, Embassy of Japan, 1987.
- *Project Director:* Role of Services in Development of Canadian Aid and Trade with Asia, CIDA, 1987.
- *Project Director:* Selected Issues in Aid and Trade with Asia, CIDA, 1987.
- *Project Director:* China Countertrade Project, Northrop Corporation, 1987.
- *Team Leader:* Summary of Medium and Large-Scale Enterprises, Volume I, Phases B&C, CIDA, 1987.
- *Team Leader:* Case Studies in MLE Development, (studies on Costa Rica, Malaysia, Korea, and Ivory Coast), Volume II, Phases B&C, CIDA, 1987.
- *Team Leader:* Discount Policy for Parcel Shipping, CPC, 1986.
- *Team Leader:* Canada's Agricultural Sector Business with the People's Republic of China, (inc. notes on Japan and Korea), External Affairs, 1986.
- *Team Leader:* Productivity Rates in the Canadian SPX Industry, CPC, 1986.
- *Project Director:* Philippines Sector Profile: Industry, CIDA, 1986.
- *Sole Consultant:* Report on Proposal to Commence a Training Program in Economic Policies in Latin America at CIEPLAN, Santiago, CIDA, 1986.
- *Sole Consultant:* Report on Industrial Service Sector Involvement in CIDA Philippines Mission, CIDA, 1986.
- *Project Director:* Medium and Large-Scale Enterprise Policy: Defining the Issues, Phase A, CIDA, 1986.
- *Project Director:* Marketing Opportunities for Western Canada's Pork and Beef in the Far West USA, Agriculture Canada, 1986.
- *Project Director:* Canada-Africa Aid and Trade Study, CIDA/BMC, 1985.
- *Team Leader:* Electronic Mail Impact on Postal Demand, CPC, 1985.
- *Project Director:* Canada-Japan Free Trade, Japanese Embassy, 1985.
- *Project Director:* Canadian Small Parcel Industry, Canada Post Corporation (CPC), 1984.
- *Team Leader:* Agricultural Trade With Japan (Pork) and East Asia (Meats, Oilseeds, and Grains), Agriculture Canada, 1984.
- *Project Director:* Canada-Asia Aid and Trade Study, CIDA/BMC, 1984.
- *Project Director:* Canadian Food Aid for Asia, CIDA, 1983-1984.
- *Team Leader:* Agriculture, Fisheries and Forestry Taskforce, Pacific Economic Cooperation Committee, Bangkok, Thailand, 1983.
- *Project Director:* Asia Future Study, Canadian International Development Agency (CIDA), 1982-1983.
- *Co-ordinator and Managing Editor:* Five volumes of Canada/Pacific Rim Economic Studies for IRPP.
- *Program Adviser:* (formerly Associate Director), Economics and Rural Development Program, International Development Research Centre (IDRC), 1980-1983.

- *Project Director*: International Trade and Industrial Development: A Six Country Study (Korea and ASEAN), while with IDRC.
- *Project Director*: Studies in Income Distribution: Chile, while with IDRC.
- *Project Director*: Agricultural Development Problems: Costa Rica and Nicaragua, while with IDRC.
- *Consultant* to the Royal Bank of Canada: Preparing overviews of political and economic prospects for medium-term development in Asia, ranging from India to Republic of Korea, 1981-1982.
- *Conference Convenor*: Fourth Pacific Trade and Development Conference, Fiftieth Anniversary of Canada-Japan Relations Conference, Southeast Asia Barriers to Trade Conference, Canadian Aid and Trade Seminar, and many others.
- *Staff Member*: Royal Commission on the Future of the Canadian Automotive Industry (Reisman Report), 1978.
- And numerous lectures at universities, seminars, overseas missions and field experience in Japan, Korea, Taiwan, Singapore, Malaysia, Thailand, Indonesia, Philippines, Sri Lanka, India, Maldives, Papua New Guinea, Egypt, Lebanon, Jordan, Guyana, Costa Rica, Panama, Chile, Argentina, Jamaica, Bermuda and Barbados.

For a profile of activities focused on other regions please contact Econolynx, Ottawa.

USPS/MPA-T4-2. Please fully describe your experience in observing and analyzing the operations of the United States Postal Service. In particular, describe your experience in observing and analyzing city carrier delivery operations. In you description, include all pertinent time periods, specific operations, facilities, Postal Service personnel with whom you had contact, and geographic locations.

Response:

None.

USPS/MPA-T4-3. Please fully describe your involvement, if any, with witness Raymond's Engineered Standards Study. In your response, indicate the time period in which you first examined the methods employed in that Study, as well as the work-sampling data collected in that study. In addition, please describe all sources of your knowledge regarding that Study.

Response:

I was in no way "involved" with the work presented by witness Raymond to the rate case, described as Raymond's Engineered Standards Study. To my knowledge no such "Study" exists. In my capacity as a witness for the MPA, I was made aware of witness Raymond's testimony and viewed various documents associated with it, after they were filed with the Commission. I have since discussed them with witness Crowder and counsel.

USPS/MPA-T4-4. When did you first become involved in the Data Quality Study mentioned at page 3 of your testimony?

Response:

Please see my answer to NAA/MPA-T4-1(a).

USPS/MPA-T4-5. Please provide copies of all contracts, agreements (including confidentiality and non-disclosure agreements), task orders, job descriptions, work proposals or other documents relating to your duties on the Data Quality Study.

Response:

Please see the attached contract. There are no other documents.

INDEPENDENT CONSULTANT AGREEMENT
NO. 102590-97-B-1972-011

This Agreement establishes the terms and conditions under which the parties have mutually agreed that **Keith A.J. Hay** (Consultant) will perform services as an independent contractor, also referred to as an **Independent Consultant**, for A.T. Kearney, Inc. (Kearney). In this capacity, Consultant will provide professional services to Kearney's Linx Group as requested by the undersigned or his designated representative, who will be identified in writing.

Consultant's compensation for services provided under this Agreement for the Decision Support Systems group of the U.S. Postal Service will be **$200.00** USD per working hour. It is understood that this is Consultant's "Most Favored Customer Rate", to be verified by submission, upon request, of copies of three (3) recent Consulting Agreements or invoices showing billings at this rate. Compensation for any other engagements will be determined upon acceptance of the engagement by the Consultant and will be reflected by a modification to this agreement.

Actual and reasonable out-of-pocket expenses incurred in the performance of services under this Agreement, such as those incurred in living and travel away from home, which are adequately documented by appropriate receipts will be reimbursed by Kearney at cost. Any questions concerning the appropriateness of such expenses should be directed to and based on the prior concurrence of the cognizant Kearney project officer(s). Consultant agrees to abide by the limitations of the United States Post Office Travel Polices (Handbook F-15) concerning First Class travel, per diem rates for lodging, meals and incidental expenses, unallowable expenses, etc. The current limits for any location to be visited will be provided by Kearney upon request.

Invoices for services and out-of-pocket expense incurred may be submitted monthly to the cognizant Kearney project officer(s) to verify their allowability, allocability and reasonableness to the Kearney client(s). A separate invoice must be prepared for each client engagement (identifying client and engagement or project by name and number) or non-client project for which Consultant has provided professional assistance. Consultant's Social Insurance Number (SIN) must be on all invoices. You must make the submissions required by Attachment A before any invoices will be paid. Details substantiating hours and expenses must be submitted with each invoice. Receipts must be provided for all expenses.

It is understood and agreed that Consultant is an independent contractor and not an employee, agent or representative of Kearney and that because Consultant is not an employee, and Kearney's insurance programs do not cover independent contractors for any purpose whatsoever, Consultant is not covered by any Kearney insurance, including the provision of disability insurance, group life insurance, medical insurance, liability insurance, workman's compensation, errors and omissions or other professional insurance or participation in Kearney's profit sharing or employee benefit plans.

Items required to verify independent status are contained in Attachment A.

It is understood that Kearney will not withhold income taxes, FICA, Social Security or unemployment taxes on Consultant's behalf and that Consultant is directly and personally responsible for the payment of Federal and State self-employment and income taxes.

It is agreed that any technology, including, but not limited to computer software, which is developed or improved by Consultant under this Agreement shall be considered to have been jointly developed or improved with Kearney and shall become the property of Kearney for the purposes of delivery to its client(s).

It is also agreed that any technology developed jointly by Consultant and Kearney, as set forth above, or any technology or other information of a proprietary or confidential nature to which Consultant becomes privy while performing services under this Agreement, shall not be disclosed to persons not party to this Agreement.

Kearney has the sole discretion to ask Consultant, upon five business days notice, to cease work for any Kearney assignment or client. If Kearney's services are terminated by a client, Consultant's services on that assignment will cease immediately upon being notified by Kearney.

The Consultant certifies as follows concerning its business status (check YES or NO for each item):

	YES	NO
Small Business	✓	—
Disadvantaged Business	—	✓
Woman Owned Business	—	✓

Any dispute of any nature arising out of this Agreement and not resolved by agreement of the parties shall be resolved by final and binding arbitration pursuant to the rules of the American Arbitration Association. An arbitrator mutually agreed upon from the roster of the American Arbitration Association shall conduct the arbitration. In the event the parties cannot agree upon an arbitrator, the American Arbitration Association shall designate a member of said Association to serve as arbitrator.

Each party shall bear its own attorneys fees and expenses arising out of any dispute, with costs of arbitration to be paid by the losing party or equally, as determined by the arbitrator. Such arbitration shall be conducted in Alexandria, Virginia.

This document constitutes the entire agreement between the parties and may not be altered, amended or modified except by written instrument signed by both parties.

This Agreement shall remain in force from June 20, 1998 through September 30, 1998, unless canceled by either party upon thirty days written notice.

This Agreement shall be governed and construed in accordance with the laws of the Commonwealth of Virginia.

A.T. Kearney, Inc.

Name: Frank M. Somerville

Title: LINX Business Manager

Date: June 20, 1998

Contact: Frank M. Somerville
225 Reinekers Lane
Alexandria, VA 22314

Telephone: (703) 739-4762

FAX: (703) 836-0547

Consultant

Name: Keith A.J. Hay

Title: President

Date: June 26/98

SIN: 429-122-641

Address: Econolynx, Intl., Ltd.
1900 Merivale Rd., Suite 200
Nepean, Ontario K2G 4N4
Canada

Telephone: (613) 723-8698

FAX: (613) 723-7333

ATTACHMENT B

Statement Of Personal Conflict Of Interest Avoidance

A.T. Kearney, Inc. Project No. TG1005

Project Name: U.S. Postal Service

(TO BE COMPLETED FOR EACH SEPARATE PROJECT/SUB-PROJECT)

I am familiar with the scope of work for the above referenced activity and believe myself to be free of any and all Conflict Of Interest (COI)* pertaining to the companies and facilities or government agencies involved, which could impair my objectivity in performing the work.

Signed: _____

Name: Keith A. J. HAY

Date: 22 June 1998

*Any of the following may constitute a potential COI:

- History of employment by or consulting to the company or companies involved.
- Employment of immediate family member by the company or companies involved.
- Employment of immediate family member by a direct competitor of the company or companies involved.

USPS/MPA-T4-6. Please provide all memos, notes, or other documentation created by you or others in the course of your work on the Data Quality Study that relate to the potential uses of work sampling data collected during the Engineered Standards Study.

Response:

I have no such documents.

USPS/MPA-T4-7. At page three of your testimony, you state that you met often with the authors of the Data Quality Study and "discussed the various data quality issues at length." Please provide the dates of all such meetings during which the work sampling data collected by witness Raymond was discussed, and for each such meeting, provide all notes or other documentation pertaining to that discussion. For each such meeting, also list the attendees of the meeting.

Response:

I was not present at any meeting where the subject of the work sampling data collected by witness Raymond was discussed. However, I was present at meetings when the general requirement for improved data quality based on acceptable scientific method, was discussed at length. I can also conclude, based on the rigor attached to the research, analysis, and discussion of other recommendations that the DQS team made, that the recommendations with regard to the Delivery Redesign work were thoroughly researched and investigated. And finally, I can with confidence say that the recommendations made were quite unambiguous and proposed up-dating the special studies and becoming involved with the Redesign project ***so as to insure*** that ***future work*** was of a satisfactory quality to enable it to be used for rate making.

CHAIRMAN GLEIMAN: I understand that there may be a procedural matter now to try to correct a faux pas on my part earlier this week.

MR. MYERS: Yes, thank you, Mr. Chairman. Pierce Myers on behalf of Magazine Publishers.

When Witness Glick's testimony was entered into the record on Monday, the appropriate declaration was not included. I have here the declaration.

I would like to move that it be transcribed into the record and received into evidence.

CHAIRMAN GLEIMAN: If you would please provide two copies to the court Reporter, I will direct that that certification be received into evidence and transcribed into the record.

[Certification for Written Direct Testimony of Sander A. Glick, MPA-T-2, was received into evidence and transcribed into the record.]

DECLARATION
OF
SANDER A. GLICK

I declare under penalty of perjury that the written Direct Testimony of Sander A. Glick (MPA-T-2) that appears at Tr. 24/11211-11239 (July 10, 2000) and the designated written interrogatory responses that appear at Tr. 24/11241-11255 (July 10, 2000) were prepared by me and that if called to testify under oath, they would be my testimony in Docket No. R2000-1.

Sander A. Glick

Executed
July 13, 2000

CHAIRMAN GLEIMAN: Now, just so everyone knows, I'm sure everyone is aware of how confused I get on the substance of rate cases. You now will know that I'm also confused from time to time on the process associated with rate cases.

When we have witnesses who appear here wearing different hats, as is the case with Mr. Glick in this proceeding, you sometimes get confused about whether you've seen them and sworn them.

And earlier this week, Witness Glick appeared and I remembered seeing him in the witness chair once before in this proceeding, and just assumed that he had been sworn in. But as it turned out, we entered his testimony with a certification that day also.

So, this is to correct the fact that I failed to swear Witness Glick at that particular point in time. I think the procedural defect is cured.

I want to thank Mr. Glick and counsel for MPA or that group of people on whose behalf he was testifying the other day for helping correct the situation.

And I think I'll swear everybody in multiple times this time. It will avoid mistakes, and it will mean that their testimony is really the full truth, the whole truth, and nothing but the truth.

With that, Mr. McKeever, if you're ready to

introduce your next witness, we'll proceed.

MR. McKEEVER: Thank you, Mr. Chairman. United Parcel Service calls to the stand, Stephen E. Sellick.

Whereupon,

STEPHEN E. SELLICK,

a witness, having been called for examination, and, having been first duly sworn, was examined and testified as follows:

CHAIRMAN GLEIMAN: Just let me mention, Mr. Sellick, I understand that you've been a bit under the weather, and we appreciate your appearance here today, especially in light of that. I just wanted you to know that if you feel you need to take a break at some point, just holler.

THE WITNESS: Thank you. I think I'm fully recovered at this point.

CHAIRMAN GLEIMAN: Well, I'm glad to hear that. In that case, you'll get no breaks.

[Laughter.]

MR. McKEEVER: Sometimes witnesses just say too much.

[Laughter.]

DIRECT EXAMINATION

BY MR. McKEEVER:

Q Mr. Sellick, I have just handed you a copy of a

document entitled, "Direct Testimony of Stephen E. Sellick on behalf of United Parcel Service on Cost Segment 3" and identified as UPS-T-2.

Mr. Sellick, if you were to testify here orally today, would your testimony be as set forth in that document?

A Yes, it would be.

MR. McKEEVER: Mr. Chairman, I move that the direct testimony of Stephen E. Sellick on behalf of United Parcel Service on Cost Segment 3 and marked UPS-T-2 be admitted into evidence and be transcribed into the record of today's proceedings.

CHAIRMAN GLEIMAN: If you would kindly provide two copies of that testimony to the court reporter, it is so ordered -- without objection? -- and I hear none.

[Direct Testimony of Stephen E. Sellick, UPS-T-2, was received into evidence and transcribed into the record.]

UPS-T-2

BEFORE THE
POSTAL RATE COMMISSION

POSTAL RATE AND FEE CHANGES, 2000	:	DOCKET NO. R2000-1

DIRECT TESTIMONY OF STEPHEN E. SELLICK ON BEHALF OF UNITED PARCEL SERVICE ON COST SEGMENT 3

TABLE OF CONTENTS

INTRODUCTION

My name is Stephen E. Sellick. I am a Vice President at PHB Hagler Bailly, Inc. ("PHB"), an economic and management consulting firm with principal U.S. offices in Washington, D.C.; Cambridge, Massachusetts; Los Angeles and Palo Alto, California; and New York, New York. PHB was formed through the merger of Putnam, Hayes & Bartlett, Inc. and Hagler Bailly, Inc. in 1998. I am located in PHB's Washington, D.C. office.

I have more than ten years of consulting experience, including a wide range of assignments in regulatory economics, cost accounting, and financial analysis of regulated industries. In addition, I have extensive experience in environmental litigation.

I have worked on PHB's analytical investigations of United States Postal Service ("Postal Service") costing issues since 1990. In Docket No. R90-1 and again in Docket No. R94-1, I assisted Dr. George R. Hall in the preparation of analyses and testimony regarding the attributable costs of Parcel Post, Priority Mail, and Express Mail. In Docket No. R94-1, I assisted Dr. Colin C. Blaydon in the preparation of analyses and testimony concerning the treatment of mixed mail costs in the In-Office Cost System ("IOCS"). In Docket No. MC95-1, I assisted Ralph L. Luciani in the preparation of analyses and testimony regarding the costs associated with parcels handled by the Postal Service in First Class and Standard (A) Mail and in preparing supplemental testimony regarding rate design for Standard (A) Mail parcels. In Docket No. R97-1, I presented direct testimony regarding the Postal Service's proposal to modify the costing in Cost Segment 3 to incorporate a Management Operating Data System ("MODS")

based approach. I also presented supplemental and rebuttal testimony in Docket No. R97-1 regarding the MODS-based approach for Cost Segment 3.

Since 1995, I have visited and observed the operations at a number of Postal Service facilities, including the Washington, D.C., BMC on two different occasions; two Sectional Center Facilities; two Associate Offices/Delivery Units; a HASP ("Hub and Spoke Project") facility; and an Air Mail Center.

I hold a B.S. in Economics from the University of Pennsylvania's Wharton School of Business and an M.A. in Public Policy Studies from the University of Chicago.

PURPOSE OF TESTIMONY AND SUMMARY OF CONCLUSIONS

I have been asked to examine the Postal Service's new methods of costing in Cost Segment 3. In so doing, I have reviewed the testimony and workpapers of Postal Service witnesses Degen (USPS-T-26) and Van-Ty-Smith (USPS-T-17), among others.

My testimony provides the following:

1. A recalculation of base year Cost Segment 3 costs using (a) the improved methods proposed by Postal Service witnesses Degen and Van-Ty-Smith and (b) the Commission's approach using 100 percent mail processing labor cost variability as proposed by UPS witness Neels (UPS-T-1);

2. An identification of the number of IOCS observations and tally dollar costs by cost pool for use by UPS witness Neels in his testimony on mail processing costs (UPS-T-1); and

3. An identification of the costs of certain Parcel Post operations which are then used by UPS witness Ralph (UPS-T-5) to calculate a more appropriate DBMC discount.

MODS-BASED ALLOCATION OF MAIL PROCESSING COSTS

The Postal Service presents several modifications and improvements to its MODS-based distribution of mail processing costs among the subclasses of mail. These modifications and improvements are discussed and presented in the testimony of Postal Service witnesses Degen and Van-Ty-Smith. Mr. Degen also discusses the degree to which mail processing labor costs are variable and therefore attributable; my testimony does not address this section of Mr. Degen's testimony. I address only the distribution of mail processing labor costs to the subclasses of mail. I recommend that, with minor programming modifications, the Degen/Van-Ty-Smith approach to distributing mail processing labor costs to each mail subclass be adopted by the Commission.

A. The Degen/Van-Ty-Smith MODS-Based Approach Addresses the Concerns Raised by the Commission in Docket No. R97-1.

The Postal Service's approach to distributing attributable mail processing labor costs to subclasses follows, for the most part, the method the Postal Service proposed in Docket No. R97-1. This method was endorsed by UPS in that proceeding (subject to minor modifications to address the "migration" of certain Administrative and Window Service costs to the Mail Processing component of Cost Segment 3 and the distribution of costs in certain "allied" pools) and was ultimately adopted by the Commission.

In this proceeding, the Postal Service proposes several changes to the approach it recommended in Docket No. R97-1:

- Costs at Non-MODS facilities have been broken into eight processing-based functional cost pools rather than being based on the "Basic Function" (e.g., incoming, outgoing, transit, and other) cost pools used in Docket No. R97-1;
- Costs associated with "not handling" in allied pools are distributed on a broader basis than proposed in Docket No. R97-1; and
- Costs in MODS "support" pools are distributed in a "piggyback" fashion based on the cost pools which those pools support.

Each of these changes represents an improvement over the Postal Service's approach in Docket No. R97-1, and they should be adopted.

B. The Postal Service's Proposed Distribution Method Should Be Used, with Minor Modifications.

The improvements the Postal Service has proposed in the distribution of mail processing labor costs in Cost Segment 3 represent a further evolution in the development of the most appropriate methodology for distributing these costs. As the Commission determined in Docket No. R97-1, improvements of this type have no necessary relationship to the degree of variability of mail processing labor costs. The methodology proposed by Mr. Degen and Ms. Van-Ty-Smith in this case can be easily adapted to incorporate full attribution of mail processing labor costs.

A further adaptation is also required to conform to Commission practice with respect to Cost Segment 3. The "migration" of some costs previously defined as Window Service (and assigned to Cost Segment 3.2) and Administrative (and assigned to Cost Segment 3.3) should be reversed to ensure treatment consistent with the Commission's established practice. These are essentially the same "migration" reversals that were required in Docket No. R97-1 to adapt the Postal Service's approach to established Commission practice, as detailed in my supplemental testimony (UPS-ST-2) in Docket No. R97-1.

Table 1 compares the Postal Service's proposal in this case with Dr. Neels' recommended (and the Commission's established) treatment of Cost Segment 3, which returns attribution of mail processing labor costs to 100 percent. UPS witness Luciani combines Dr. Neels' recommended treatment as reflected in my Table 1 with the recommendations of other UPS witnesses to calculate the combined impact of all of these changes on Parcel Post, Priority Mail, and Express Mail in the Test Year.

TABLE 1

BY1998 Volume Variable Cost Segment 3 Costs by Class/Subclass

Class and Subclass of Mail or Special Service	Postal Service Proposal	100% Attribution
Total First Class Mail	**7,573,871**	**8,522,117**
Priority Mail	**733,035**	**901,232**
Express Mail	**127,161**	**185,985**
Mailgrams	**192**	**253**
Total Periodicals	**738,428**	**813,249**
Total Standard (A) Mail	**3,151,448**	**3,479,195**
Standard (B) Mail		
Parcel Post	260,580	275,359
Bound Printed Matter	134,482	143,723
Special Standard	86,972	93,043
Library Mail	12,397	13,035
Total Standard (B) Mail	**494,431**	**525,160**
US Postal Service Mail	**157,624**	**197,640**
Free Mail	**15,573**	**16,808**
International Mail	**294,530**	**339,278**
Total Mail	**13,286,293**	**14,980,919**
Total Special Services	**365,777**	**361,356**
Total Volume Variable	**13,652,070**	**15,342,275**
Other	**3,994,053**	**2,304,197**
Total Accrued	**17,646,123**	**17,646,472**

Sources: Postal Service Proposal – USPS-T-11, Exhibit USPS-11A, pages 1-2. 100% Attribution – UPS-Sellick-WP-1-A, page 2. Calculation of Total Accrued does not match exactly due to rounding.

CALCULATION OF IOCS OBSERVATIONS AND TALLY DOLLARS BY COST POOL

At the request of UPS witness Neels, I have calculated the number of IOCS observations and the IOCS tally dollar costs in each cost pool by mail class and non-mail activity code. These results are provided in Sellick-WP-2.

CALCULATION OF NON-BMC OUTGOING MAIL PROCESSING COSTS INCURRED BY DBMC-ENTRY PARCELS

At the request of UPS witness Luciani, I have calculated, using the Postal Service's basic approach outlined in USPS-LR-I-103, the non-BMC outgoing mail processing costs incurred by DBMC entry parcels. This approach uses IOCS data to determine the proportion of IOCS tally dollars by MODS pool and IOCS Basic Function that can be ascribed to DBMC Parcel Post and non-DBMC Parcel Post. This calculation shows that $9.34 million in Base Year 1998 attributable mail processing costs are for outgoing DBMC parcels at non-BMCs.[1] The details of the calculation are provided in Sellick-WP-3.

SUMMARY OF CONCLUSIONS

In conclusion, I find that:

- The approach to distributing attributable mail processing labor costs to subclasses as proposed by Postal Service witnesses Degen and Van-Ty-Smith is

1. This approach is based on Postal Service volume variabilities for mail processing labor costs; the calculation using 100% volume variability can also be found in my workpapers.

an improvement over past practice and, with minor modifications, should be adopted by the Commission. The Postal Service's proposal continues the refinement of mail processing costing methods to more closely align the distribution of mixed mail and overhead costs to mail processing operational characteristics and continues to use the available data on counted mixed mail. The result is an improved distribution of the costs in Cost Segment 3.

- The Postal Service's approach can be implemented while maintaining the Commission's historic practice of attributing 100 percent of mail processing labor costs. The Base Year results of this approach are provided in this testimony.

- The Postal Service's calculation of the costs avoided by DBMC-entry parcels incorrectly includes $9.34 million of costs which are actually incurred by DBMC-entry parcels.

CHAIRMAN GLEIMAN: Mr. Sellick, have you had an opportunity to examine the packet of designated written cross examination that was made available earlier today?

MR. McKEEVER: Mr. Chairman, I'm afraid I dropped the ball on that one. I think there are very few interrogatories, which I can give to Mr. Sellick now.

CHAIRMAN GLEIMAN: I would appreciate if you would do that and we will give him a moment to review them.

[Pause.]

THE WITNESS: Yes, I have.

CHAIRMAN GLEIMAN: If those questions were asked of you today, would your answers be the same as those you previously provided in writing?

THE WITNESS: Yes, they would be.

CHAIRMAN GLEIMAN: That being the case, counsel, if you could provide two copies to the court reporter, I will direct that that material be transcribed into the record and received into evidence.

[Designated Written Cross-Examination of Stephen E. Sellick, UPS-T-2, was received into evidence and transcribed into the record.]

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, DC 20268-0001

Postal Rate and Fee Changes, 2000 Docket No. R2000-1

DESIGNATION OF WRITTEN CROSS-EXAMINATION
OF UNITED PARCEL SERVICE
WITNESS STEPHEN E. SELLICK
(UPS-T-2)

Party	Interrogatories
United States Postal Service	USPS/UPS-T2-1-2

Respectfully submitted,

Cyril J. Pittack
Acting Secretary

INTERROGATORY RESPONSES OF
UNITED PARCEL SERVICE
WITNESS STEPHEN E. SELLICK (T-2)
DESIGNATED AS WRITTEN CROSS-EXAMINATION

Interrogatory	Designating Parties
USPS/UPS-T2-1	USPS
USPS/UPS-T2-2	USPS

**ANSWER OF UNITED PARCEL SERVICE WITNESS SELLICK
TO INTERROGATORY OF
THE UNITED STATES POSTAL SERVICE**

USPS/UPS-T2-1. Please refer to your testimony, UPS-T-2, at page 2, lines 15-18, where you state that you provide "[a] recalculation of base year Cost Segment 3 costs . . . using 100 percent mail processing labor cost variability as proposed by UPS witness Neels (UPS-T-1)."

a. For cost segment 3.1, confirm that by "costs," you specifically mean volume-variable costs by cost pool and subclass. If you do not confirm, please specify the correct meaning of "costs."

b. Confirm that the "costs" you calculate for cost segment 3.1 are consistent with Dr. Neels' proposals. If you do not confirm, please explain fully.

c. Confirm that the "costs" you compute for cost segment 3.1, by cost pool and subclass, can be expressed as the product of total cost for the pool, a volume-variability factor equal to (or nearly equal to) one (or 100 percent), and a distribution key share for the cost pool and subclass derived from IOCS data. If you do not confirm, please provide the expression you believe to be correct.

Response to USPS/UPS-T2-1.

(a) Confirmed.

(b) The costs I calculate for cost segment 3.1 are consistent with Dr. Neels' conclusion that a volume variability of 100 percent is appropriate for mail processing labor costs. See Dr. Neels' response to USPS/UPS-T1-2(a).

(c) Confirmed.

ANSWER OF UNITED PARCEL SERVICE WITNESS SELLICK
TO INTERROGATORY OF THE UNITED STATES POSTAL SERVICE

USPS/UPS-T2-2. Please refer to your testimony, UPS-T-2, at page 5, lines 2-6. You state, "The 'migration' of some costs previously defined at Window Service (and assigned to Cost Segment 3.2) and Administrative (and assigned to Cost Segment 3.3) should be reversed to ensure treatment consistent with the Commission's established practice." Please also refer to your Docket No.R97-1 response to USPS/UPS-T2-17 (Docket No. R97-1, Tr. 26/14222), where you stated that you "have not testified that the existing [pre-Docket No. R97-1] method for distributing administrative costs is more accurate than witness Degen's proposed methodology."

a. Please explain whether it is still the case that, as you stated in Docket No. R97-1, your current testimony, UPS-T-2, does not indicate "that the existing [pre-Docket No. R97-1]method for distributing administrative costs is more accurate than witness Degen's proposed methodology."

b. If your response to part (a) indicates that you now believe that there is a reason (or reasons) to reverse the "migration" of costs, other than to "ensure treatment consistent with the Commission's established practice," please state and describe fully each reason, and provide all related data and/or analysis that supports your position.

Response to USPS/UPS-T2-2.

(a) As in Docket No. R97-1, I have not testified in this case that the existing (pre-Docket No. R97-1) method for distributing administrative and window service costs

is more accurate than the methodology proposed by witnesses Degen and Smith. As in Docket No. R97-1, I reverse the "migration" of certain costs previously defined as Window Service and Administrative in order to preserve the treatment (both for volume variability and in cost distribution) that is consistent with the Commission's established practice.

(b) Not applicable.

CHAIRMAN GLEIMAN: Is there any additional written cross examination for this witness?

If not, that brings us to oral cross examination.

The Postal Service is the only party that has filed a request for oral cross examination of this witness.

Does anyone else care to cross examine the witness?

If not, then Ms. Duchek, you may proceed when you are ready.

MS. DUCHEK: Thank you, Mr. Chairman.

CROSS EXAMINATION

BY MS. DUCHEK:

Q Good morning, Mr. Sellick.

A Good morning.

Q I just have a very few questions for you.

Would you please turn to your response to Postal Service Interrogatory 1.

A I have that.

Q And would you take a moment to review subpart (c), please?

A Yes, I have reviewed that.

Q In subpart (c) you confirmed that the costs you compute for Cost Segment 3.1 by cost pool and subclass can be expressed as the product of total cost for the pool of volume variability factor equal to or nearly equal to one or

100 percent and a distribution key share for the cost pool and subclass derived from IOCS data.

I would like you to consider the IOCS-based distribution keys for the cost pools for the MODs Function 1 sorting operations, such things as BCS, OCR, FSM and the like.

Is it your understanding that the distribution key shares by subclass for those MODs Function 1 cost pools are the same as the shares of the dollar weighted handling tallies?

A By dollar weighting, are you referring to the IOCS dollar weighting or the effect after -- for after weighting for the MODS pool dollars?

Q The IOCS.

A I think there's probably an effect of weighting for the MODS pool dollars in there, but I would need to go back and look at that specifically and I don't believe I have specifically focused on that.

Q That's fine. For the MODS Function 1 sorting operation cost pools that we have just been talking about, would the distribution key shares be the same if you simply dropped the not handling distribution step?

A My recollection is that the Postal Service's current programming actually does not count the not handling IOCS tallies in the development of the distribution keys and

it puts those dollars back in or effectively reweights the final distribution for the not handling tallies at a later stage.

Q And do your programs do the same thing?

A My programs -- the way I developed the costs that ultimately end up, that I ultimately derive for Cost Segment 3 are based on both the Postal Service programming modified for 100 percent volume variability as well as the Postal Rate Commission's programming in order to reverse the migration of tallies from Cost Segment 3.1 to 3.2 and 3.3.

Q And do you believe that the distribution key method for those MODS Function 1 sorting operation cost pools is reasonable?

A And by the distribution key method you refer to, that is the Postal Service's method?

Q Your method.

A My method, I believe my method is the same as the Postal Service's method and I do believe it is reasonable, yes.

MS. DUCHEK: Thank you very much. I have no further questions.

CHAIRMAN GLEIMAN: Is there any follow-up?

[No response.]

CHAIRMAN GLEIMAN: Questions from the bench?

[No response.]

CHAIRMAN GLEIMAN: Mr. Sellick, UPS witnesses have made proposals for the treatment of mail processing costs and you have used base year FY '98 data to show the effects of those proposals.

On July 7th in response to Commission Order 1294 the Postal Service provided updated test year results that reflected the use of FY '99 actual data as the base year for cost projection purposes.

We expect additional data including underlying calculations and document to be submitted by the end of next week, by July 21st.

Order 1294 contemplates parties updating their presentations using FY '99 data or using FY '99 data in some manner as they may see fit.

Could we expect for you to update and submit, resubmit your testimony reflecting the cost information presented by the Postal Service for mail processing using FY '99 data as that information comes in and is made available otherwise by the Postal Service?

MR. McKEEVER: Mr. Chairman, may I address that question on behalf of the client?

CHAIRMAN GLEIMAN: I suspect so.

MR. McKEEVER: We do anticipate doing that, Mr. Chairman, barring any unforeseen difficulties and I guess it would probably Mr. Sellick who would do it, although we

frankly haven't given that thought and that is why I just didn't want Mr. Sellick to be on the spot there.

CHAIRMAN GLEIMAN: Okay, thank you. I appreciate that and just so everyone understands, we ask because while Mr. Sellick was on the stand because he did present the effects of the FY '98 data associated with other UPS witnesses' treatment of mail processing costs, as was anticipated by the Order 1294 and by our scheduling adjustments we expect other parties if they so desire to provide updates also.

We are not necessarily looking for more paper, but we are looking for as good a record as we possibly can get and upon which to base any recommended decision we might make.

If there are no follow-ups to the comment and my request just now, and the other questions that were asked by the Postal Service, that brings us to time for redirect, if you would like some time to prepare your witness, Mr. McKeever.

MR. McKEEVER: We have no redirect, Mr. Chairman.

CHAIRMAN GLEIMAN: If there is no redirect, then Mr. Sellick, that completes your testimony here today.

We appreciate your appearance and your contributions to the record, and I am glad to hear you are feeling better and you are excused.

THE WITNESS: Thank you, Mr. Chairman.

[Witness excused.]

CHAIRMAN GLEIMAN: Mr. Richardson, I believe you have our next witness.

MR. RICHARDSON: Thank you, Mr. Chairman.

The Office of the Consumer Advocate calls Dr. J. Edward Smith.

CHAIRMAN GLEIMAN: Now I know I have seen this witness around the place a little bit but I suspect I haven't sworn him in in this proceedings yet.

Whereupon,

J. EDWARD SMITH,

a witness, was called for examination by counsel on behalf of the Office of the Consumer Advocate and, having been duly sworn, was examined and testified as follows:

CHAIRMAN GLEIMAN: Counsel, you may proceed.

DIRECT EXAMINATION

BY MR. RICHARDSON:

Q Would you please state your name for the record?

A My name --

CHAIRMAN GLEIMAN: Could you please turn your mike on?

THE WITNESS: My name is J. Edward Smith.

BY MR. RICHARDSON:

Q And I have just provided you two copies of your

testimony, captioned, "Direct Testimony of J. Edward Smith on behalf of the Office of the Consumer Advocate," styled OCA-T-4.

Do you have those?

A I have it.

Q And that testimony includes revisions filed on June 28th on page 5, lines 5 to 6, which deleted the language "holding delivery points and other nonvolume factors constant," is that correct?

A That is correct.

Q And was this testimony prepared by you or under your direction?

A Yes, it was.

Q And do you have any additions or corrections to your testimony?

A Yes, I do.

On page 6, line 1 of my testimony, please delete the word "to" -- t-o -- on page 6, line 2, add the word "and" after the comma. On page 13, line 8, add the word "adjacent" before "accounting periods". On page 13, line 9, add the word "adjacent" before "accounting periods".

That concludes my revisions.

Q With those corrections do you adopt this as your testimony in this case?

A I do.

MR. RICHARDSON: Mr. Chairman, I will hand two copies of the testimony to the court reporter.

CHAIRMAN GLEIMAN: If you would do so, I will direct that the testimony of Witness Smith be transcribed into the record and entered into evidence.

MR. RICHARDSON: And the revisions are made in the copies.

CHAIRMAN GLEIMAN: The corrections and revisions are included in the copies that were handed to the court reporter. Is that correct?

MR. RICHARDSON: That is correct.

[Direct Testimony of J. Edward Smith, OCA-T-4, was received into evidence and transcribed into the record.]

OCA-T-4
Docket No. R2000-1

DIRECT TESTIMONY

OF

J. EDWARD SMITH

ON BEHALF OF

THE OFFICE OF THE CONSUMER ADVOCATE

MAY 22, 2000

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UNITED STATES OF AMERICA
Before The
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

Postal Rate and Fee Changes, 2000) Docket No. R2000-1

DIRECT TESTIMONY OF J. EDWARD SMITH

I. STATEMENT OF QUALIFICATIONS

My name is J. Edward Smith, and I am an econometrician with the Office of the Consumer Advocate of the Postal Rate Commission. I have previously worked in a variety of economic assignments in industrial, academic, consulting, and governmental positions. My experience has focused on the modeling of costs and revenues; economic analysis related to forecasting, project analysis, production and strategic planning; and rates, prices, marketing, and planning analysis. My economics degrees are an A.B. from Hamilton College, and an M.S. and Ph.D. from Purdue University. I have testified approximately 20 times before regulatory commissions, most recently before the Postal Rate Commission on mail processing volume variability in Docket No. R97-1.

II. PURPOSE AND SCOPE OF TESTIMONY

The purpose of my testimony is to evaluate the volume variability analysis for segment 3 mail processing costs presented by Dr. A. Thomas Bozzo.[1] Dr. Bozzo's work was a continuation of Dr. Michael D. Bradley's pioneering work on mail processing costs variability presented in Docket No. R97-1.[2] Volume variability measures the percentage change in cost with respect to the percentage change in volume. Dr. Bozzo measured the variability of cost, measured in hours worked, with respect to changes in the volume of mail, as measured in terms of total pieces handled (TPH) or total pieces fed (TPF).

Traditionally the Commission has assumed that mail processing volume variability is 100 percent. Dr. Bozzo measured variabilities for 10 mail processing activities and found variabilities ranging from 52 percent to 95 percent. Volume variability is an important issue, for segment 3 mail processing costs are in excess of $17 Billion, and the variabilities applied to the various cost pool costs associated with the activity are used to yield a measure of attributable costs. Costs that are not attributable become institutional, requiring that the Commission recommend assignment of the costs to various rates, classes and categories.

[1] Dr. Bozzo's testimony appears in this docket in USPS-T-15, Docket No. R2000-1.

[2] Witness Bradley's testimony appeared in Docket No. R97-1 as USPS-T-14.

My evaluation of Dr. Bozzo's study is based on whether the study meets the following evaluation criteria mentioned by the Commission in Docket No. R97-1:[3]

1. A study should include the development and use of an adequate database, appropriately verified and complete.
2. The study should include a discussion of the modeling approach and how it is consistent with the underlying data.
3. An adequate model and analysis of functional properties is necessary.
4. A correct estimation procedure that is suitable to the estimation needs at hand should be used.
5. Results for econometric equations and alternative econometric analyses should include a full explanation of the values, signs, and other relevant information for the variables.

The Commission has also indicated some of the procedures by which it reviews econometric work:

1. First, the Commission reviews the econometric research using the criteria for evaluation.
2. Second, the Commission reviews the statistical properties of the estimates.
3. Finally, the Commission tries to identify a preferred model to find a result that it can safely rely upon: a result that is stable and robust.

In considering Dr. Bozzo's study I will first review Dr. Bradley's study (for purposes of providing a background and context evaluation). I will then discuss the

[3] Docket No. R97-1, *Opinion and Recommended Decision*, Volume 2, Appendix F at 1.

degree to which Dr. Bozzo's study meets the evaluation criteria. If the research fails to meet the criteria cited, the Commission may decline to accept the conclusions and apply traditional volume variabilities or apply the best of several unsatisfactory alternatives, pending further analysis.

My analysis of the database issue focuses on the scrubbing process and the adequacy of the variables. I address the modeling issues by focusing on the theoretical economic issues as impacting the modeling process. Estimation procedures can include a variety of econometric models. I discuss Dr. Bozzo's choice of the fixed effects model and possible alternatives. I comment on how the evaluation criteria could be reviewed by the Commission. Although Dr. Bozzo's study is a follow-on work to Dr. Bradley's study, many of the problems associated with the original study continue to be found in the revised study. I also comment on how the estimation process could be concluded in a way that could be satisfactory to all participants through the implementation of a working group.

III. INTRODUCTION: VOLUME VARIABILITY OF MAIL PROCESSING COSTS

A. Both Dr. Bradley and Dr. Bozzo Have Presented Analyses of Segment 3 Mail Processing Costs.

Volume variability for mail processing is defined as the percentage change in cost that results from a percentage change in volume. Both Dr. Bradley and Dr. Bozzo measured costs in terms of person hours of segment 3 mail processing effort. Dr. Bradley measured volume in terms of total pieces handled (TPH), and Dr. Bozzo measured volume in terms of total pieces fed (TPF) or in some cases total pieces handled (TPH). The econometrically estimated variabilities of Drs. Bradley's and Bozzo's testimony are presented in Table 1.

The Postal Service operates over 38,000 offices, stations, branches, and processing and distribution centers providing for mail collection, processing and sorting, and delivery. The mail processing plants, where the segment 3 labor costs are generated, prepare the mail, sort the mail to three or five digits, and dispatch the mail to subsequent destinations for additional sorting or distribution. In his testimony in Docket No. R97-1, Dr. Bradley modeled 25 mail processing and handling activities at the major mail processing plants (denoted as MODS facilities) and at Bulk Mail Centers (BMCs).[1] Dr. Bozzo has limited his updated study to the analysis of ten mail sorting activities in the MODS operations. As was well documented in Docket No. R97-1, there was

[4] MODS offices perform the various sorting activities and report costs and volumes through the Management Operating Data System; non-MODS offices tend to be smaller, perform the same types of functions as do MODS offices, but do not report through the Management Operating Data Systems. There are over 300 MODS offices. The number of non-MODS offices is substantially larger. The 21 Bulk Mail Centers (BMCs) process packages and report their data through the Productivity Information Reporting System (PIRS).

significant disagreement with to Dr. Bradley's methodology, including serious problems with data scrubs and data checking, disagreement over the use of the fixed effects estimation approach. There was also concern about the lack of explanatory variables and the relationship of the econometric model to economic theory.

Mail processing costs comprise a significant portion of Postal Service costs. Total costs in the Base Year were $59.6 Billion, with segment 3 costs at $17.6 Billion.[5] According to witness Van-Ty-Smith, the segment 3 costs consist of $12.5 Billion in MODS offices, $0.8 Billion in BMCs, and $4.4 Billion in non-MODS facilities.[6] Dr. Bradley's testimony presented the first comprehensive analysis of volume variability. In his testimony, Dr. Bozzo traced the history of the assumption of 100% volume variability for segment 3 costs. He stated that the era of the assumption of 100 percent volume-variability was based on analysts' judgments by a task force formed in the late 1960's.[7] He testified that methodological, computational, and theoretical constraints had previously limited the econometric analyses of volume variability.

B. The Estimated Volume Variabilities Presented by Dr. Bradley and Dr. Bozzo Differ, but the Variabilities are in General Substantially Less than 100 Percent.

The estimated volume variabilities presented by Dr. Bradley and Dr. Bozzo in Table 1 are generally less than 100 percent.[8] The variabilities are subsequently used

5 Direct testimony of Karen Meehan, USPS-T-11, Exhibit 11A at 2 and 8.

6 Direct testimony of Eliane Van-Ty-Smith, USPS-T-17 at 24-25.

7 USPS-T-15 at 4, lines 7-18.

8 The discussion is limited to consideration of only those activities for which Dr. Bozzo presented estimated variabilities. In UPS/USPS-T15-9, Dr. Bozzo indicated that he had omitted 24 observations (continued on next page)

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by USPS Witness Van-Ty-Smith in conjunction with Pool Total Cost to compute Pool Volume-Variable Cost. Of the segment 3 Total Pool Cost of $5.4 Billion relevant to the variabilities estimated by Dr. Bozzo, the application of the variabilities developed by Dr. Bradley would lead to the conclusion that $4.4 Billion of cost would be volume variable. In comparison, the use of the variabilities developed by Dr. Bozzo would lead to the conclusion that $4.1 Billion would be volume variable. If the costs were 100 percent volume variable, then $5.4 Billion would be directly assigned.[9] Thus Dr. Bozzo's attribution proposal would reduce attributable costs by $1.3 Billion and increase institutional costs by a similar amount. This transfer of costs between accounting pools is of such a magnitude that it will most certainly influence the rates recommended by the Commission.

from the data set and reran the estimation of variabilities. However, the changes to the results were very minimal. Since the results were not statistically significant, he did not subsequently refile Appendix E. Accordingly, because the changes are *de minimis* and since the original numbers are clearly set forth in his testimony and can be considered statistically accurate, I am working with his written testimony as filed and adopted by him. None of my comments would change based on the information he has presented.

[9] USPS-T-17, Docket No. R2000-1 at 24, (Van-Ty-Smith).

Table 1
Mail Processing Activity

	Variabilities Dr. Bradley	Variabilities Dr. Bozzo	Total Cost $--000	Attributable Cost per Dr. Bradley $--000	Attributable Cost per Dr. Bozzo $--000
BCS Sorting	0.945	0.895	1,043,841	986,430	934,238
OCR Sorting	0.786	0.751	219,070	172,189	164,522
FSM Sorting	0.918	0.817	1,042,369	956,895	851,615
LSM	0.905	0.954	78,765	71,282	75,142
SPBS Non Priority	0.469	0.641	283,275	132,856	181,579
SPBS Priority	0.802	0.641	82,447	66,122	52,849
Manual Flats	0.866	0.772	459,933	398,302	355,068
Manual Letters	0.797	0.735	1,563,963	1,246,479	1,149,513
Manual Parcels	0.395	0.522	60,593	23,934	31,630
Manl. Priority Mail Srtg	0.448	0.522	259,762	116,373	135,596
Cancel. And Mail Prep.	0.654	0.549	295,957	193,556	162,480
Subtotal			5,389,975	4,364,418	4,094,231
Composite Variability				0.81	0.76

C. The Commission Has Identified Criteria and Standards that Can Serve as a Basis for the Evaluation of an Econometric Study.

The Commission discussed in Docket No. R97-1 the standards and criteria for the evaluation of an econometric analysis.[10] The Commission reviewed comments by witnesses Bradley, Neels, and Smith. The relevant criteria for the evaluation of the adequacy of an econometric study are well understood:

1. A study should include the development and use of an adequate database, appropriately verified and complete.
2. The study should include a discussion of the modeling approach and how it is consistent with the underlying data.
3. An adequate model and analysis of functional properties is necessary.

[10] Docket No. R97-1, *Appendices to Opinion and Recommended Decision*, Volume 2, Appendix F.

4. A correct estimation procedure that is suitable to the estimation needs at hand should be used.

5. Results for econometric equations and alternative econometric analyses should include a full explanation of the values, signs, and other relevant information for the variables.

The Commission has also indicated some of the procedures by which it reviews econometric work. First, the Commission reviews the econometric research using the criteria for evaluation. Second, the Commission reviews the statistical properties of the estimates. Finally, the Commission tries to identify a preferred model to find a result that it can safely rely upon; that is, a result that is stable and robust.

IV. DR. BRADLEY'S STUDY

A. A Review of Dr. Bradley's Study Highlights Previous and Potential Problems Associated with the Measurement of Volume Variability.

There were significant data, methodological and estimating problems associated with Dr. Bradley's original study. Unfortunately, these problems have carried over, in general, to Dr. Bozzo's study, so it is appropriate to first examine Dr. Bradley's study in some detail. Dr. Bradley's testimony presented two major conclusions that differed from the traditional assumptions about volume variability:

- There are differences in volume variabilities for mail processing across activities; and
- The estimation of mail processing variabilities generally produces a number less than 100 percent.

Both UPS witness Neels and I disputed the results, focusing on the variety of issues related to databases, variables, model specification, and other factors.[11] Dr. Bradley's estimation of mail processing was performed at the level of the individual mail processing activity. Table 2 summarizes Dr. Bradley's 25 estimated mail processing variabilities. Based on total mail processing labor costs disaggregated into activity-specific cost pools, Dr. Bradley estimated cost elasticities by modeling hours of labor (which he designated as a measure of cost) as a function of total pieces handled (TPH),

[11] UPS-T-1, Docket No. R97-1 (Neels); OCA-T-600, Docket No. R97-1 (Smith).

deemed to be a measure of output.[12] Additional explanatory variables included a segmented time trend, and a manual ratio (computed as the ratio of manual letter TPH to the sum of all manual letter TPH, mechanized letter TPH, and automated letter TPH). He also used seasonal dummy variables to denote the accounting periods to account for the ebbs and flows of mail throughout the year.

[12] This summary of Dr. Bradley's work is not comprehensive or complete, focusing only on the essential highlights of his work. For example, Registry and Encoding were separately estimated.

Table 2
Summary of Dr. Bradley's Variabilities

Activity	Variabilities Estimated by Dr. Bradley	Comparable Activities Estimated on the Basis of Proxies	Proxy Variability
MODS Offices		*General Support Activities*	
BCS Sorting	0.945	Mail Processing Support	System Variability
OCR Sorting	0.786	Miscellaneous Processing	System Variability
LSM Sorting	0.905	Empty equipment	System Variability
FSM Sorting	0.918	Damaged Parcel Rewrap	System Variability
Manual Letter Sorting	0.797	Piece Handlings Unavailable	
Manual Flat Sorting	0.866	Mechanized Sack Sorting	BMC Mech. SS
Manual Parcel Sorting	0.395	Mechanized Parcel Sorting	BMC Mech. PS
Manual Priority Mail Sorting	0.448	Bulk Presort	Opening Units
SPBS Priority Mail Sorting	0.802	Manual Sack sorting	BMC Platform
SPBS Non Priority Mail Sorting	0.469	Mailgram Sorting	Manual Ltr Sorting
Cancellation and Mail Prep	0.654	Express Mail Sorting	Manual Pri. Sorting
MODS Allied Activities		ACDCS (Scanning)	Pouching
Opening Pref Mail	0.720	Business Mail Reply	Manual Ltr Sorting
Opening Bulk Business Mail	0.741	*Customer Service Activities*	
Pouching	0.829	Automated Sorting/Stations	OCR & BCS
Platform	0.726	Mechanized Sorting/Stations	LSM and FSM Activities
Remote Encoding	1.000	Manual Sorting/Stations	Manl Lrt. and Manl. Flat
Registry	0.150	Box Section Sorting/Stations	Manl Lrt. and Manl. Flat
		Express Mail Sorting,CSOMan	Manual Pri. Sorting
BMC Offices		Special Service Activities	Registry Activity
Sack Sorting	0.991	Misc Activities at CSO	Registry Activity
Primary Parcel Sorting	0.854	Mail Markup and Forwarding.	Avg. Mech. Activities
Secondary Parcel Sorting	0.969	Business Mail Entry	Platform Activity
Irregular Parcel Post	0.754		
Sack Opening Unit	0.718		
Non Machinable Outsides	0.672		
BMC Allied Activities			
Platform	0.533		
Floor Labor	0.605		

Data Sources
USPS-T-14, Docket No. R97-1, page 9.

B. Dr. Bradley's Study Was Criticized as Being of a Short-Run Nature Due to the Use of 4-Week Accounting Periods Coupled with the Lack of Consideration of Capital and Investment.

The Commission has indicated that the postal rate cycle, the period of time over which postal rates are fixed, is the appropriate time period for the purposes of

determining the relationship between costs and mail volume.[13] In contrast, Dr. Bradley's study focused on 4 week accounting periods along with some consideration of longer time frames. There was no longer-run consideration of costs as related to the facility expansion path,[14] which is the relevant approach to the measurement of costs. The Commission indicated that the cyclical nature of mail volume over a rate cycle implied that the relationship between input use and mail volume across adjacent accounting periods will reflect, primarily, seasonal variation in mail volume. Large changes in volume across adjacent accounting periods can occur with little change in labor hours across adjacent accounting periods, leading to a low variability estimate. I will subsequently show that Dr. Bozzo's study is also short run: the use of quarterly data, and even a "same period last year" analysis, does not change its short-run nature.

C. The Database for Dr. Bradley's Study Was Unreliable.

The MODS and PIRS databases provided observations by accounting period (AP) and site for the years 1988-1996. Dr. Bradley scrubbed the data for accuracy, continuity, and adequacy, resulting in the establishment of a database consisting of data by site, accounting periods, and activities. The data sets were large, with up to 25,000 observations or more.[15] Although the database was large when measured in terms of quantity of data, the major relevant data generated from a field site and used in

[13] Docket No. R97-1, *Opinion and Recommended Decision*, Volume 2, Appendix F at 13.

[14] The expansion path is the equilibrium point of costs as facility size changes.

[15] Data sets were typically in the 17,000-25,000 observations range after scrubbing. A few data sets were significantly smaller.

the study (exclusive of information relating to facility identification, activity type, and time periods) consisted only of two variables: hours and TPH. Furthermore, the accuracy of the MODS data was substantially criticized. Dr. Bradley concluded that extensive data scrubbing was necessary. Substantial argument concerning the deficiencies of Dr. Bradley's scrubbing process generally focused on the elimination of relevant data. The scrubbing process appeared to be largely statistically based; there did not appear to have been a detailed review of the data with field personnel. Information on capital, facility characteristics and a variety of other data relevant to the analysis of mail processing were not included in the data set.

D. Dr. Bradley's Fixed Effects Approach Was Criticized by the Commission

Dr. Bradley estimated the relationship between hours and TPH with a translog function, using a fixed effects approach for the econometric estimation. In the analysis of a specific activity, he asserted that the fixed effects intercept was adequate to account for differences between facilities.[16] In selecting the estimation method for the translog function, Dr. Bradley considered three estimation approaches as possible choices:

- **Pooled:** If this approach had been used, then according to Dr. Bradley the approach would have been based on the assumption that facility-specific

[16] An issue that was not considered was whether some degree of segmentation into data subsets for the facilities would have improved the estimation process. Instead, Dr. Bradley assumed that the fixed effects approach would account for the differences.

characteristics were not important.[17] Dr. Bradley indicated that he rejected the pooled model approach for this reason, relying on the Gauss-Newton Regression (GNR). He stated that in every case the GNR tests indicated that the facility-specific effects were important and that both the pooled and the cross sectional models were not appropriate.

- **Fixed Effects:** The reasons cited for the differences in hours between facilities included the age of the facility, the quality of the local work force, and the quality of the mail that the facility must process.[18] Dr. Bradley indicated that his experience in studying mail-processing activities strongly suggested that there were significant non-volume variations across facilities as indicated by a Gauss-Newton Regression.[19] The fixed effects approach attempts to capture differences between facilities not captured by the variables in the equations, as measured by the intercept. However, the approach works only in measuring fixed effects at a site when the fixed effects never change.
- **Random Effects:** Dr. Bradley rejected the random effects model, and no participating party advocated such a model. Such an approach would be based on the assumption that the facility specific characteristics that cause productivity to vary across facilities are non-stochastic.

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[17] To the degree that data modeling the characteristics of a facility could be developed, such data could be included in the study as exogenous variables.

[18] USPS-T-14, Docket No. R97-1 at 40, lines 1 through 4.

[19] This is a key point. Subsequent testimony will disagree with some of the findings, and this has a key impact on conclusions. Dr. Bozzo also used a fixed effects approach. He appears to have provided inadequate explanation and response to the Commission's comments on fixed effects.

The Commission found that the fixed effects in Dr. Bradley's study may represent effects that are both related and unrelated to postal volumes; for example, the size of the facilities, included in the fixed effects, can be a function of the volume of mail. Accordingly, the Commission found that if the fixed effects were volume variable, then the computed volume variabilities were incorrect. Dr. Bozzo has again used the fixed effects estimating procedure.

E. Dr. Bradley Extrapolated His Econometric Results to a Number of Other Activities.

Dr. Bradley performed the analysis of mail sortation for a limited number of activities at MODS offices and BMCs. The results did not entirely meet witness Degen's needs, for Mr. Degen was required to form cost pools for certain activities that had no recorded workload measures. Since workload measures were unavailable, variabilities could not be measured econometrically. Therefore, Dr. Bradley used activities for which he had computed variabilities as proxies for activities for which he had been unable to compute variabilities. Finally, he extrapolated the results for variabilities for mail handling activities to non-MODS offices.[20] Dr. Bradley's conclusion that cost variabilities for mail processing activities are less than one was a major change from the traditional 100 percent assumption. He commented on his understanding of why variabilities are less than one:

- the existence of relatively fixed functions within the activity,

[20] USPS-T-14, Docket No. R97-1, Section V at 86-90.

- the division and specialization of labor (leading to the conclusion that manual activities should have increased efficiency), and
- technological change, resulting in machine paced activities operated at the same speed having a high variability.[21]

He indicated that gateway activities (*e.g.*, OCR and platform) would run at both low and high levels depending on the time of day. Finally, he assumed backstop activities would tend to have lower variabilities.[22]

[21] USPS-T-14, Docket No. R97-1 at 56.

[22] USPS-T-14, Docket No. R97-1 at 58.

V. DR. BOZZO'S VOLUME VARIABILITY STUDY

A. Dr. Bozzo's Revisions of 10 of the 25 Mail Processing Activities Modeled by Dr. Bradley Continue to Have Deficiencies.

Dr. Bozzo made a number of changes to Dr. Bradley's methodology; however, the approach continues to be fatally flawed.

(1) Dr. Bozzo's approach continues the short run approach to estimation. In the previous study, the mail processing elasticities only reflected the response of costs to volume changes on an eight weeks basis. Dr. Bozzo has modified the data to a quarterly basis, but the analysis is still based on short run costs, measuring changes in cost with respect to volume but not adequately addressing issues of capacity utilization and investment--which can have a significant impact on longer-run costs through their effects on facility expansion. Movements along a facility expansion path in response to volume changes will occur when capital and labor vary on a longer-term basis as a result of the Postal Service's investment plans. The expansion path is the hyperplane that should be measured, not the short run hours/TPF relationship.

(2) There is less data scrubbing, but the rules for the data scrubbing are not significantly better. There was apparently no discussion with field based personnel of the data on a site by site basis for data items suspect (unless required to answer an interrogatory).

(3) Microeconomic theory related to cost, production, and factor demand functions is interspersed with comments on non-cost minimization, homotheticity, and a variety of other sophisticated concepts. However, the theory is not presented in an

organized form. There appears to be a number of theoretical errors. This is not a trivial issue. The treatment of capital could potentially have a significant effect on the conclusions, but it is not clear whether capital is an exogenous or endogenous variable and whether some type of reduced form simultaneous equations system is needed.

(4) Variables assumed non-volume variable that are actually volume variable: the manual ratio is still present, and capital is treated as exogenous when it may in fact be endogenous.

(5) The economic theory does not appear to be well tied to the mail processing field realities. There is a major difference between the model estimated by Dr. Bozzo and the alternative model that can be developed from Mr. Degen's testimony.

(6) Dr. Bozzo has incorporated capital in the analysis; however, the actual measurement of capital appears to be inaccurate or inapplicable.

(7) The econometric methodology continues to be fixed effects, even though the major deficiencies of this approach were discussed in detail in the previous case.

(8) There has been some introduction of additional variables, for example, the consideration of networks. However, a potentially key variable--capacity utilization--is missing. The previously discredited manual ratio continues to be used.

B. Dr. Bozzo's Study Needs Substantial Work for Completion.

The analysis of mail processing facilities is a complex, intellectually challenging issue. The volume variability analysis has consumed major resources, apparently up to five years for the initial work presented by Dr. Bradley, and another five person years of

work for the work presented by Dr. Bozzo, which was, however, performed on a much more limited scope of activities. Possibly another five person years of effort would be required to complete the work.

Furthermore, Dr. Bozzo has only estimated 10 of the previously estimated 25 variabilities that Dr. Bradley estimated. In addition there are a large number of MODS and non-MODS variabilities which have not yet been estimated. Finally, there are significant methodological issues in dispute over the work.

Accordingly, it is important that volume variability issues be thoroughly and additionally explored before being adopted by the Commission. The current estimators appear to be tentative. As can be seen from Table 1, the proposed variabilities have actually changed over the short course of several years, apparently due to changes in data scrubbing and methodological changes.

I recognize that the tone of my testimony is negative, as related to both the testimony of Dr. Bradley and the follow-on work of Dr. Bozzo. Although it would have been satisfying to present new econometric methodologies and economic theories carried to their ultimate conclusions, I have found that such an accomplishment is not possible within a four month time frame--particularly since such an effort would apparently require in excess of five person years of work. Accordingly, I am recommending to the Commission the following approach to a resolution of the volume variability issues.

C. The Commission Should Recommend Establishment of a Working Group to Resolve the Mail Processing Issues.

The resolution of the volume variability issue has major cost allocation implications, and extensions and improvements to the work appear likely to require a significant amount of additional effort. That effort can best be accomplished in the atmosphere of a working group in which technical issues can be discussed and resolved in a non-adversarial atmosphere. In this way, I believe many of the more technical issues regarding the handling of the data and variables and the estimators could be substantially narrowed. Accordingly, the Commission may wish to consider recommending that the Postal Service establish an ongoing working group of interested intervernors and other interested groups for the review, analysis, and conclusion of the study.

VI. DR. BOZZO'S METHODOLOGY IS EVALUATED UNDER ESTABLISHED CRITERIA

I have listed, above, the several deficiencies that I conclude are present in the USPS modeling of mail processing variabilities. Standing alone, without placing them in the context of an overall evaluation of the methodology in a structured way, it may be difficult for the Commission to weigh the relative significance of individual issues in a laundry list of problems in the context of a full-blown analysis. That is, certain issues may appear to be concerned with minutia, of little overall significance to the resolution of the problem. As the Commission has stated, "The blueprint for a successful application of econometrics is well-understood...."[23] An econometric study is judged by whether it successfully meets generally established criteria. I am therefore presenting my testimony in a format discussing five important criteria similar to that which the Commission recognized as appropriate for evaluating econometric methodology. In measuring Dr. Bozzo's study against these criteria, I have found the study deficient in important respects in each of the areas. The following sections present an evaluation of Dr. Bozzo's work in terms of the criteria discussed in Appendix F of the Commission's opinion in Docket No. R97-1.

[23] Docket No. R97-1, *Opinion and Recommended Decision*, Volume 2, Appendix F at 1.

A. Criterion 1: A Study Should Include the Development and Use of an Adequate Database, Appropriately Verified and Complete.

1. The database was not adequately examined and verified for accuracy.

A review of the data scrubbing issues associated with Dr. Bradley's work provides some insight into the inadequacy of the underlying databases for both studies. The Commission concluded that the scrubs were excessive because they eliminated usable data and ineffective because the rules applied in the scrubs did not reliably identify erroneous observations. The Commission concluded that the scrubs produced a selection bias by unduly affecting the estimated variabilities.[24] The Commission indicated that, "It is the Commission's understanding that good econometric practice requires that when data are removed from a sample, they are removed because the econometrician has investigated and found good cause for believing that the data are erroneous."[25]

Dr. Bradley's initial data review appears to have been based on the application of statistical analysis. The differences between Dr. Bradley's data set and the data set used in the current study are actually quite minor. Quarterly data are used in the current study in lieu of four week accounting period data in order to smooth out inaccuracies; the rejection criteria are relaxed; and the overall time period is changed due to a major data discontinuity at the time of the Postal reorganization.

[24] *Id. at* 31.

[25] *Id. at* 28.

The underlying data bases from which Dr. Bradley obtained the data for the study are unreliable. As the Commission indicated, "Even without the report of the Inspection Service, a conscientious examination of the data sets would disclose unmistakable internal evidence of serious errors."[26] The data set used in the current study apparently continues to be drawn from the same data source and appears to have been initially subjected to minimal actual field verification. Field level data verification appears to be required to provide a sound basis for the analysis. Several of Dr. Bozzo's responses to interrogatories appear to focus on data checking "after the fact." One response discussed data errors due to commingling of manual and SPBS parcels, and a gap in the manual priority volume reporting at a site.[27] The response also discussed data questions related to 13 sites, largely involving reclassifications of facilities or the introduction of new facilities. This is the type of data verification that should be performed prior to beginning the analysis.

In view of the known deficiencies of the MODS data base, as well as the changing nature of the data as verified by questions raised in interrogatories, I conclude that the database should have been subjected to substantial field verification for accuracy and completeness. Such verification could be performed initially on a sampling basis to verify the degree of accuracy. Follow-up efforts would involve contact with the people responsible for data collection to determine data accuracy as well as to gather information on site specific circumstances. The actual examination and

[26] *Id. at* 26.

[27] UPS/USPS-T15-13, Tr. 15/6387-8.

verification of data from sites with input from field personnel does not appear to have been performed to any significant degree.

Statistical data scrubbing is not an adequate substitute for on-site data verification. A proper approach to the verification of data is to select a sample of data items and perform a field check to determine reliability. Procedures must then be implemented to upgrade the data set if the data prove to be unreliable.

In performing the data review, there was no discussion of the possible segmentation of the database into subsets of similar sites to facilitate accurate comparisons. Clusters of sites could have been considered by size, degree of technology and automation (thereby avoiding the meaningless manual ratio), the clustering of processing activities, and probably other classifications. By grouping similar sites, much of the fixed effects problem identified by the Commission could be avoided. A smaller number of sites based on clustering might produce less precise statistical estimates; however, the tradeoff might be increased accuracy.

An example of the importance of the data issue was provided in an interrogatory response that indicated there were large upward revisions to the manual parcel and priority variabilities due largely to the application of tighter sample selection rules.[28] It is reasonable to conclude that the study is deficient in terms of its underlying database, and that the conclusions may be tentative, depending significantly on data scrubbing.

[28] AAP/USPS-T15-5, Tr. 15/6227.

2. Changes in postal investment subjected the investment data trends to changes during 1994-96; previous data may be unrepresentative of operating conditions in the forthcoming rate effective time period.

The history of Postal Service investments in mail processing equipment is summarized in Table 3 and the accompanying graph.[29] Table 3 indicates that the Postal Service's investment in mail processing equipment changed during 1994-1996. It remained, on average, at a level much higher than the level of investment in the three previous years, 1993 through 1995. Thus, the investment expenditures in the early years included in Dr. Bozzo's study differ significantly from the investment expenditures for the later years. Moreover, plans for future Postal Service investments are delineated in the annual investment capital plans,[30] and the Postal Service continues to project a high level of investment in mail processing equipment. It therefore appears that part of the data relied upon by Dr. Bozzo is not representative of the period for which the rates will be in effect. According to Dr. Bozzo, the potential impact of unrepresentative data is important:

> My main motivation for employing data over a shorter time period was the desire to balance the potentially competing aims of efficient estimation and accurate estimation of the labor demand functions....However, extending the sample period back in time does not hold other things equal. It raises the possibility of introducing non-sampling errors in the estimates to the extent the earlier data are unrepresentative of current operations."[31]

[29] ANM/USPS-T9-47-49, Tr. 2/199-202.

[30] ANM/USPS-T10-17, Tr. 2/408.

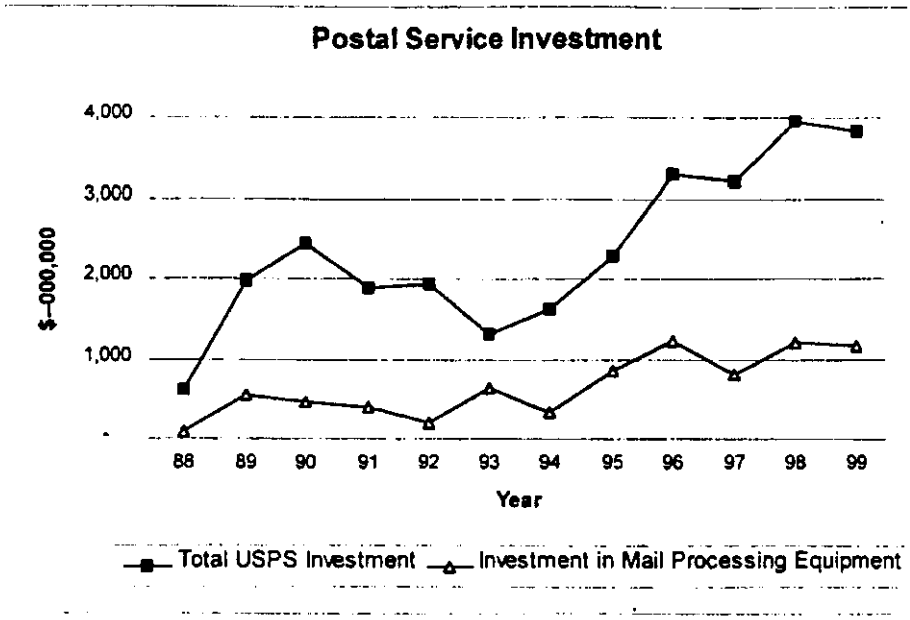
[31] OCA/USPS-T15-6, Tr. 15/6298.

Fluctuations in the investment data may make them unrepresentative for purposes of analysis. The investment data will impact the values for capital, possibly making earlier data irrelevant to current practices. The investment data are plotted in the following graph derived from Table 3.

Table 3
Postal Service Investment--1988-1999

Year	Total Postal Service Investment $--000,000	Mail Processing Equipment Investment $--000,000
88	623.9	91.9
89	1,987.5	560.0
90	2,436.4	466.4
91	1,883.1	397.7
92	1,924.8	201.1
93	1,309.6	634.5
94	1,635.5	326.9
95	2,284.9	866.8
96	3,306.9	1,220.5
97	3,202.6	808.2
98	3,947.0	1,204.1
99	3,817.3	1,158.1

Source: ANM/USPS-T9-47-49, Attachment



Accordingly, in examining the Hours/TPF relationships, Dr. Bozzo has an underlying investment series that may be unrepresentative of current operations. The changing nature of segment 3 data for segment 3 hours and total mail is shown on an aggregate basis in Table 4 in terms of payroll hours for segment 3 and total mail. There was a major change in trend in the 1997 time frame. Dr. Bradley treated a similar discontinuity with a dummy variable, but Dr. Bozzo has not addressed the impact on his conclusions of the changing trends.

Table 4
Mail Volume and Segment 3 Hours

Year	Volume Total All Mail	Cost Segment 3 Payroll Hours Work (Clerks & Mailhandlers)
1999	201,576,279	694,845,627
1998	196,904,690	694,686,240
1997	190,888,059	693,945,735
1996	183,439,474	680,293,834
1995	179,932,615	667,448,113
1994	177,177,362	654,575,064
1993	170,312,972	617,449,610
1992	165,654,138	615,041,369
1991	165,057,806	631,555,134
1990	165,502,505	633,771,319
1989	161,603,263	641,645,471
1988	160,953,625	638,779,872
1987	153,152,758	626,078,466
1986	146,578,077	603,546,949
1985	140,097,956	582,351,682
1984	131,544,622	560,064,472
1983	118,476,588	524,770,256
1982	113,121,664	518,265,011
1981	110,130,400	525,640,282
1980	116,451,141	528,221,756
1979	99,828,883	527,506,828
1978	96,913,154	517,087,887

3. The continued use of the manual ratio is undesirable.

Dr. Bozzo continues to use the manual ratio as a measure of the degree of automation. Recognizing that the manual ratio can be affected by volume, he nevertheless maintains that the mail processing technology rather than mail volumes determine the manual ratio.[32] He maintains that a computed manual ratio number is comparable from site to site, even though the size of the sites may range from small to

[32] USPS-T15 at 24, line 11.

large.[33] However, he also admits that to the extent network characteristics affect local mail flows and automation usage, they may affect the manual ratio variable.[34] Finally, he appears to believe that the size of the mail processing facility as measured in TPF would not affect the manual ratio, *other things equal*, but since the TPF are likely to be related to network characteristics one would expect that other things are not, in fact, equal.[35]

In my view, use of the manual ratio in the analysis is inappropriate. Other measures of the degree of automation for an activity need to be developed; for example, the capacity and numbers of machines for an activity at a site could be used as a measurement of automation capability.

4. The QICAP variable has not been demonstrated as appropriate.

(a) The presentation of the variable QICAP, used to measure capital usage at each facility, is inadequate.

The regression equations, as outlined on pages 117 and 118 of Dr. Bozzo's testimony, use a variable denoted as "CAP". Apparently, this is the QICAP variable referenced in LR-I-107.[36] QICAP is denoted as a quantity index for facility capital. The value of the capital items at a facility are depreciated, adjusted for inflation, and transformed into a capital flow. The details of the procedure were apparently presented

[33] OCA/USPS-T15-8, Tr. 15/6301.

[34] OCA/USPS-T15-11, Tr. 15/6305.

[35] OCA/USPS-T15-15, Tr. 15/6309.

[36] USPS-LR-I-107, Docket No. R2000-1.

in the previous case.[37] The derivation of QICAP was discussed during an informal technical conference with Dr. Bozzo and was also the subject of interrogatories. However, the presentation of the derivation of QICAP is inadequate; QICAP is not even discussed in Dr. Bozzo's testimony, and it is impossible to determine the relevance of previously presented information to the current use of QICAP. There are a number of deficiencies associated with the QICAP variable.

(b) The variable QICAP appears to be deficient from a computational viewpoint.

The use of the variable QICAP in a regression equation might yield spurious results. Dr. Bozzo indicates that the QICAP numbers are not strictly additive from site to site.[38] He indicates that they are approximately additive, but that additional computations need to be made. Accordingly, Dr. Bozzo has not demonstrated that QICAP is a cardinal number although on a practical basis it may be possible to perform sufficient computations to adjust the number for adequacy under certain circumstances. Regression equations are based on the addition and multiplication of numbers in the matrices that define the regression equation. Numbers that yield inaccurate results when added or multiplied may result in the wrong conclusions.[39] Accordingly, there may be a mathematical problem in using QICAP in a regression equation.

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[37] USPS-LR-H-272, Docket No. R97-1.

[38] OCA/USPS-T15-45, Tr. 15/6341-2.

[39] A very simple example will illustrate this: if the price of food rises by 3percent and the price of clothing rises by 2 percent, then prices are not up by 5 percent.

(c) QICAP is available on a facility basis, not on an activity level basis; this may lead to meaningless results when including capital investment in the study.

The variable QICAP is available only on a facility basis. QICAP is a measure of the capital used at a facility rather than for an activity. For example, at a site with various types of automated or mechanized operations (*e.g.*, cancellation, bar code sorters, optical character readers) and manual operations (*e.g.*, manual sorting of parcels or letters), only one number is available: the overall amount of capital used at the facility. Furthermore, capital used in activities that are not even being modeled is also included in QICAP as long as the capital is present at the facility. Accordingly, the modeling of any activity at a facility is based on the overall usage of capital at the facility, regardless of whether the particular activity is capital intensive or uses capital minimally.

Dr. Bozzo essentially maintains that the QICAP variable in its current state is the best estimate of capital usage available. He maintains that it is not possible to classify all equipment at a site by cost pool. According to Dr. Bozzo, the resulting cost pool level capital measures which would result from segmenting available data by activity cost pool would not represent the cost pools of capital *per se*, but rather, they would represent the portion of the cost pools capital that could be associated with the cost pool using the Property Code Number (PCN). He further notes that data on facility space, which he alleges to be an important non-equipment component of a hypothetical

cost pool capital index, are not available by cost pool.[40] He further maintains that it is not obvious that a cost-pool-level capital measure would be the sole–or even the primary economically relevant measure of capital. He has indicated that, in his view, the effect of including the facility capital index is to capture the fixed effect on labor demand in a given cost pool of the capital services employed in that cost pool as well as the capital services employed in other pools.

An example illustrates the deficiency of QICAP. Witness Kingsley has discussed the installation of Flat Sorting Machines in detail. Such machines will provide a higher level of automation than currently exists. Apparently machines of significantly less capital value, sophistication, and capability are currently in use at the mail processing facilities. Based on Mr. Degen's and Ms. Kingsley's testimonies, it is clear that most major mail processing facilities have sophisticated, high capability Optical Character Reader (OCR) and Bar Code Sorter (BCS) machines. Accordingly, in any analysis of FSM's at a given site, the QICAP variable appears likely to reflect to a disproportionate degree the investments in OCR and BCS machines. In analyzing the flat sorting activity, one would be using a value for capital strongly influenced by other activities.

A further example demonstrates a potentially greater mismatch, if instead of considering flat sorting machines, one considers the manual casing of mail. Regardless of how sophisticated the automated activities of the plant are, it does not appear that

[40] Although square feet of space clearly cost money, Dr. Bozzo has not explained how the associated space affects hours of labor.

this investment will have much impact on the manual casing of letters, a technology in existence for many years.

(d) Some of Dr. Bozzo's computations illustrate the dubious nature of the variable QICAP.

Turning to Table 6 of Dr. Bozzo's testimony,[41] one can compare the capital elasticity of manual flats and manual letters with that of a bar code sorter. The capital elasticities for the manual operations are greater than the capital elasticities for the OCR. The conclusions that one could draw from Table 6 do not comport with reality, and there is inadequate discussion of the results. At the very least, some extensive discussion of the results should be provided. For purposes of analysis, it appears that capital data are needed at the activity level if activities are to be analyzed. A statement that such data are not available does not suffice as a reason for its non-inclusion.

(e) The approach to equipment depreciation and the failure to consider maintenance efforts also renders QICAP meaningless.

The Postal Service depreciation rates, by equipment category, are as follows: mail processing equipment, 8.3 percent per year; postal support equipment, 11.5 percent per year; and buildings, 2.33 percent per year.[42] QICAP is used as a measure of capital for mail processing machines. Dr. Bozzo asserts that from an economic viewpoint the machines have useful value consistent with the geometric perpetual

[41] USPS-T-15 at 119.

[42] OCA/USPS-T15-47, Tr. 15/6344-5.

inventory equation.[43] Dr. Bozzo has justified the accelerated depreciation rate as being based on internal Postal Service studies; however, these are internal studies based on previous, historical experience. The modern equipment that is currently being installed may be quite different from that installed previously, rendering the historical depreciation rates meaningless. In addition, the depreciation rates being used appear to be based on accounting data rather than operational reality: it is difficult to imagine that an FSM is 8.3 percent less productive after its first year on the job.

In an industrial setting, various vintages of the same machine may be present on the factory floor. Regardless of the level of depreciation accrued by the accountants, the machines will typically have the same level of productivity when operating. The major difference (if any) between the machines is that the older machines may require increased maintenance. From the viewpoint of activities in factories, there will usually be a relationship between hours of operation and levels of maintenance based on the age (*i.e.*, depreciation) of the machinery after a few years. Older machines will maintain their operability as they depreciate through increased maintenance. Accordingly, in comparing vintages of capital it is necessary simultaneously to consider maintenance: maintenance hours, operating hours, and capital equipment are strongly interrelated.

However, no management or maintenance time is included as a variable in the regression analysis.[44] Even assuming QICAP is correct from a depreciation point of view, one would need to note that operating and maintenance labor is carried in

[43] OCA/USPS-T15-49, Tr. 15/6349.

[44] OCA/USPS-T15-63, Tr. 15/6376.

another account but is a complement to machine operating time. Accordingly, the study is seriously deficient without consideration of management and maintenance hours.

5. Capacity utilization is another potentially important variable missing from Dr. Bozzo's database.

It is well known that the output, efficiency, and resource requirements of factory operations are strongly related to capacity utilization. For example, it is common knowledge that investors, economists, and the financial press examine factory capacity utilization as a signal of price, employment, and other economic changes. For an industrial style process, capacity utilization is a key number.[45] Dr. Bozzo's study has no measure of capacity utilization, and this is a potentially serious deficiency. Furthermore, there is no reason to believe that TPF or TPH are approximations of capacity utilization. Dr. Bozzo treats them as an output, so while they may be correlated with capacity under certain circumstances, they do not measure capacity. It should also be obvious that capacity utilization is not measured as a fixed effect. Accordingly, the lack of a capacity utilization variable is a major deficiency of the model.

6. In conclusion, there are serious data problems underlying the foundation of the study.

The data problems associated with the current study include data scrubbing/non verification, problems with specific variables (QICAP, manual ratio), the potentially unrepresentative nature of the data series, and issues associated with omitted

[45] If capacity utilization were at 100 percent, it would still be possible to increase production in the short run through extraordinary measures, and in the longer run through the addition of machines and/or plants.

variables. Dr. Bozzo's database does not appear to meet the standards of reliability. Finally, a potentially key variable, capacity utilization, is missing.

B. Criterion 2: Models Should Be Derived from the Appropriate Economic Theory and Should Fit Correctly Within any System that Applies Them.

1. The economic assumptions and theory for the current study are not clear; in many cases they appear to be wrong.

Both Dr. Bradley and Dr. Bozzo used translog functions to estimate the relationship of labor hours and TPF or TPH. Dr. Bozzo indicated that "....I find that Dr. Bradley's lack of stated cost theoretic underpinnings for his mail processing study added unnecessary confusion to the Docket."[46] A similar statement also applies to the work that Dr. Bozzo has presented. The econometric testimony in this proceeding is replete with references to advanced microeconomic price theory. However, the underlying microeconomics are interspersed throughout the presentation. Accordingly, it is difficult to follow the logical progression of the derivation, properties, and logic of the analysis and the functions being estimated.

On a preliminary basis I have identified the following problems, which will be considered in the following sections:

- Statement of the function being estimated;
- Selection of variables to be estimated;
- Treatment of Network issues;
- Variables: Manual Ratio and QICAP;

[46] USPS-T-15 at 44, lines 18-20.

- Time Frame: Short run and long run; and
- Cost minimization

2. Dr. Bozzo and Dr. Bradley do not agree on the type of function being estimated; much improvement in the presentation of the labor demand function is needed.

Dr. Bradley estimated the relationship of hours and TPH, which he denoted as a cost function. Dr. Bozzo defines the relationship as a labor demand function. Both economists are estimating what is essentially the same function. The function obviously cannot be both a cost function and a labor demand function. This confusion highlights the absence of a clear economic exposition of economic theory and assumptions.

Dr. Bozzo indicates that his labor demand function is actually a conditional labor demand function that can be derived from a partial equilibrium model of cost minimization or from a generalized non-cost minimization model. However, he performs neither derivation, and the reader and ultimately the Commission are left with the problem of constructing the theories underlying his testimony. [47]

The Commission's comment in discussing Dr. Bradley's cost function is again applicable. The Commission said that, "Given the arbitrary nature of witness Bradley's cost equation, the Commission's criticism in Docket No. R87-1 that 'an imaginative analyst can obtain almost any desired variability estimate by carefully choosing the variables and the time period to be used in the analysis' seems to apply."[48] Dr. Bozzo's

[47] OCA/USPS-T-15-56, Tr. 15/6358-9.

[48] Docket No. R97-1, *Appendices to Opinion and Recommended Decision*, Volume 2, at 8.

conditional labor demand function is open to similar criticism. First, a labor demand function is defined as $x_j=x_j(w_1, w_2..w_n, p)$ for $j = 1...n$. For estimating purposes, appropriate derivations from the production function would yield an estimating equation, specified in terms of the production function variables. As indicated by Dr. Bozzo, the mathematical relationship between the cost function and labor demand function, known as Shepard's lemma, provides that if the cost function is locally differentiable, the labor demand function is equal to the partial derivative of the cost function with respect to the wage.[49] It is possible that the Postal Service operates under conditions in which Shephard's lemma does not apply. Dr. Bozzo responded to a question about "cases of non-equilibrium" conditions under which his theory is substantiated:

> To the extent that the term refers to situations under which the relevant theoretical conditions of the cost minimizing (or generalized non-cost minimizing) model do not hold, my results would still represent an empirical analysis of the Postal Service's demand for labor in mail processing operations, but the mathematical relationship ("Shepard's lemma") between the labor demand and cost functions would not necessarily hold.[50]

Dr. Bozzo did not fully explain the applicability of his labor demand function. Dr. Bozzo has also indicated that he included variables to bridge the gap between generic theory and operational reality. He indicated that the labor demand models used, and the cost functions implicitly associated with them, employ additional variables for that reason.[51] In order to verify that Dr. Bozzo's approach is grounded in economic theory,

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[49] OCA/USPS-T-15-17, Tr. 15/6311-2.

[50] OCA/USPS-T-15-59(a), Tr. 15/6365-6.

[51] OCA/USPS-T-15-56(c), Tr. 15/6358-9.

the Commission needs an explicit derivation of the labor demand function, an additional analysis of the endogenous or exogenous nature of investment, and a discussion of the impact on labor demand under conditions of monopsony, monopoly, and imperfect competition. This would alleviate concerns about variables in the equations and whether additional equations were needed, particularly in view of Dr. Bozzo's comments about exogenous and endogenous variables.

3. Dr. Bozzo's study is short run. The proper approach for examining postal facilities is on a longer-run basis as related to major investment plans and movement along the facility expansion path.

The concepts of the short run and the long run are clear from the viewpoint of theoretical economics. In the *short run* some of the factors of production (for example, labor) are variable. In the *long run*, all of the factors of production are variable. Postal Service investments in capital to reduce operating costs indicate a long run approach is applicable to the analysis. Instead of measuring the short run relationship between labor and volume, the appropriate relationship to measure is the movement along the expansion path that occurs when the Postal Service invests in new plant and equipment. This focus on the expansion path reflects changes in the scale of the facility as incremental labor or incremental capital are added.

In Docket No. R97-1, I advocated that a pooled equation could measure the longer-run expansion path. However, it has become increasingly clear that the labor hour/TPF data points gathered based on field data probably measure mail processing at a variety of disequilibrium points, based on varying capacity utilization and varying levels of mail. Accordingly, in a subsequent section I advocate that the regression

analysis at this time should be performed on data means rather than on the larger data set of individual observations that would be used in the pooled case. This is probably the "least bad" approach, even though various statistical deficiencies have been noted.

Dr. Bozzo states that, "Since capital is treated as a quasi-fixed factor, I am estimating 'short run' functions."[52] Dr. Bozzo's approach is wrong; there is a need to measure longer-run functions. He is only measuring transitory changes in mail processing.

The Postal Service witnesses and management appear to have a time frame of as little as one year to as much as five years in mind when they discuss the longer run, the period over which capital investment varies. The time frame seems to center on the two to three year range.

Dr. Bozzo recognizes that there are short-run and longer-run aspects of clerk and mail handler labor mail processing demands and that labor can fluctuate in the short run:

> My review of witness Moden's testimony (Docket No. R97-1, USPS-T-4) and discussions with Postal Service operations experts revealed that there are two main staffing processes. One process assigns the existing complement to various operations to meet immediate processing needs, and operates on time scales on the order of hours (let alone eight weeks). However, the longer term process of adjusting the clerk and mail handler complement operates more slowly--our operational discussions suggested up to a year.[53]

[52] OCA/USPS-T15-61, Tr. 15/6373.

[53] USPS-T-15 at 18, lines 6-13.

In conclusion, it would appear that there are several time periods relevant to the estimation of postal costs. One time period is a day, the period over which very short-term adjustments to labor are made on an operational basis. A second time frame appears to be the 4 week or 3 month time frame used by Dr. Bradley and Dr. Bozzo. Both of these time frames have little relevance to the longer-run expansion plans that seem to drive mail processing costs, have little relevance without information on capacity utilization, and may represent unreliable data readings for plants operating in a mode that is significantly different from equilibrium.[54] Finally, a longer-run time period, which would appear to approximate the length of the rate effective time period in the neighborhood of two years, seems to be the time frame over which investment, personnel, and equipment decisions are realized. Given the increasing importance of capital investment decisions to the Postal Service, this would appear to be the relevant time frame.

Mr. Degen also recognizes the ongoing length of the investment process: "From initial proposal to project completion, it may take anywhere from 6 to 9 years to bring a new plant on line. Site acquisition, planning, and approval for a new plant can easily take 5-7 years and actual construction another 1-2 years."[55] Apparently the Postal Service sites new plants to adjust to the network on a continuing basis, in recognition of increasing Postal flows. Accordingly, the actual longer-run time frame in which an

[54] Apparently, the set of mail-processing plants is under continuous modifications as plants are added, subtracted, and modified in the network. In some cases, the data generated by the plants may be of a transitory nature and irrelevant to the analysis.

[55] USPS-T-16, at 15, lines 4--7.

investment decision is made and implemented after a relatively protracted planning framework appears to be in the neighborhood of two years. Dr. Bozzo has also recognized that investment is an ongoing process, indicating that major equipment deployments usually take more than one year.[56]

It appears that a longer term model would best be approximated by a cross sectional analysis as modeled by the "between" model, based on Mr. Degen's testimony as outlined in his Figure 3.

4. Dr. Bozzo addressed Dr. Bradley's omission of variables in the regression equations. Dr. Bozzo considers additional variables, but the consideration is still deficient.

Dr. Bozzo indicated that:

> Since the additional explanatory variables--particularly wages and network variables--are statistically significant, my results indicate that Dr. Bradley's Docket No. R97-1 mail processing models for the operations I studied were under specified. As a result, Dr. Bradley's results appear to exhibit omitted-variables biases to some degree. However, since the revised variabilities accounting for these factors are lower, contrary to the expectations set forth in the Commission's Docket No. R97-1 analysis, the direction of the omitted variables biases in Dr. Bradley's results were mainly upwards, not downwards.[57]

The problem of which variables are to be included in a regression equation is a major problem in applied econometrics. I am concerned that the work presented is still lacking in important variables: a measurement of capacity utilization, specific capital measurements relating to activities rather than facilities, capital measurements that are additive, and possibly other variables. The analysis of network effects, and the

[56] OCA/USPS-T15-13, Tr. 15/6307.

[57] USPS-T-15 at 127, lines 10-17.

variables considered, is also, in my opinion, deficient; this is discussed in another section of my testimony.

5. The newly presented information about networks needs to be fully incorporated in the analysis.

There are repeated references to mail processing networks in both Dr. Bozzo's and Mr. Degen's testimonies. Although networks have not been previously referenced in regards to segment 3 mail-processing costs, the concept of the network has been in the literature in at least some form since at least 1986.[58] Mail processing activities and sites do not stand alone in terms of the network of originating and destination nodes. There seem to be three types of network issues. First, there is the intra-plant network of activities that feed mail to each other. One gets the impression that this network could change based on a variety of factors, including network volumes. A second type of network effect is apparently the delivery configuration of the service territory. Dr. Bozzo measures this network configuration with a variable measuring the number of possible deliveries. Finally, the position of the plant in the mail flow between other mail processing plants also seems to be a type of network relationship. According to an interrogatory response, the size of facilities and their mail processing operations depends not only on the volume of mail processed, but also their position in the Postal Service's network.[59]

[58] Laurits R. Christensen Associates, *United States Postal Service Quarterly Real Output, Input, and Total Factor Productivity, 1982 Quarter 1 Through 1986 Quarter 1, March 1986*; "A Report to Charles Guy, Director, Office of Economics, United States Postal Service," in USPS-LR-H-272, Docket No. R97-1.

[59] USPS-T-15 at 26, lines 4-6.

The analysis conducted by Dr. Bozzo addressed only the possible deliveries; he did not address the networking of activities at the plant level or the interchange of mail between plants. Both of these types of network effects might have an impact on labor demand.[60] These factors, often in conjunction with volumes, appear to determine the length of processing windows, the complexity of mail processing schemes, the relative amount of labor required for set up and take down activities, the operation's role as a gateway or backstop, other indicators of the level of costs, and the degree of volume variability. Accordingly, both Mr. Degen and Dr. Bozzo have introduced an important concept. The Commission has not reviewed networks in the recent past in evaluating Dr. Bradley's testimony, and this concept, which is new to the segment 3 analysis, does not appear to have been developed adequately.

6. Dr. Bozzo estimates mail processing activities (*e.g.*, manual processing, OCR, BCS) as independent activities; based on witness Degen's comments on networks and facilities, serious consideration needs to be given to the simultaneous modeling of activities.

Dr. Bozzo's approach is focused on single activities at a time: he treats the mail-processing activities as separable. However, mail-processing activities are not performed alone; this is partly recognized by Dr. Bozzo in his discussion of capital investment. Based on my experience with batch production processes I would expect that the operation of one mail processing activity is not independent of another. Dr.

[60] USPS-T-15 at 47.

Bozzo referenced *Freight Transportation Regulation* by Friedlaender and Spady.[61] They advocate the specification of a cost function in terms of multiple outputs. When asked if he considered such an approach in his estimation efforts, Dr. Bozzo indicated, "Yes. First, to characterize the set of operations for which I report econometric results, I employ ten equations with ten output (piece handling) variables; additionally, each equation includes other non-volume 'cost drivers' in addition to piece handlings. Second, my analysis is an element of the Postal Service's 'distribution key'."[62] Dr. Bozzo apparently considered the operation of each activity as being separable from another. However, Friedlaender and Spady seem to advocate simultaneous consideration of activities.

The relationship of processing patterns, volumes of mail, and the interaction of activities appears to be inadequately addressed in Dr. Bozzo's analysis. During oral cross-examination, Dr. Bozzo acknowledged that the mix of activities in operation at a site has an impact on the hours per TPF relationship.[63] He maintained that the use of the manual ratio captured the effect. Although the use of the manual ratio as a measure of the degree of automation is subject to serious criticism, there is no clear (or possibly even existing) relationship between the manual ratio and the activities at a site. The issue requires additional exploration.

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[61] Ann F. Friedlaender, Richard H. Spady, *Freight Transport Regulation*, Cambridge, MIT Press, 1981.

[62] OCA/USPS-T15-61(e), Tr. 15/6373-4.

[63] Tr. 15/6417.

7. Dr. Bozzo's treatment of homotheticity appears to lead to incorrect conclusions.

In his testimony Dr. Bozzo asserts that "...capital and labor variabilities will be identical, in equilibrium, under the assumption that the cost-pool-level production (or cost) functions are *'homothetic'*...Homotheticity implies that changing the level of output of the operation will not alter relative factor demands such as the capital/labor ratio, in equilibrium (and other things equal)."[64] However, the Postal Service testimony is replete with examples of the implementation of major investment programs designed to reduce costs. This concept was further developed in the Postmaster General's recent speech in Nashville.[65] The focus is on the elimination of major labor costs via capital investment to achieve an overall reduction of total costs. Accordingly, the application of a homotheticity assumption appears to be an inappropriate assumption.

8. Dr. Bozzo has raised some important issues about cost minimization; resolution of the issues may affect the cost segment 3 analysis.

Dr. Bozzo has stated that his theory is independent of whether the Postal facilities minimize costs and, in support, cites a publication by Toda.[66] Dr. Bozzo's testimony does not discuss QICAP and he has provided only a limited amount of useful information in this proceeding on the development of the variable QICAP. Accordingly, I

[64] USPS-T-15 at 40, lines 10-14.

[65] Prepared remarks at the National Postal Forum, Nashville, Tennessee, March 20, 2000, See OCA/USPS-98, Tr. 21/9152.

[66] The article introduced by Dr. Bozzo on the topic of non cost minimization appears to be by Yasushi Toda, "ESTIMATION OF A COST FUNCTION WHEN THE COST IS NOT MINIMUM: THE CASE OF SOVIET MANUFACTURING INDUSTRIES, 1958-1971," *The Review of Economics and Statistics*, Vol. LVIII, August 1976, 259-268.

have relied on the library reference that he has mentioned.[67] The documents referencing QICAP are filled with references to Total Factor Productivity. Toda's article shows that measurements of Total Factor Productivity may be incorrect when computed for non-cost minimizing firms. Dr. Bozzo indicates that his measurement of QICAP does not depend on a measurement of Total Factor Productivity (which the Postal Service appears to use in other circumstances). It is not clear what the impact of the Toda article would be; however, this is an issue that needs to be reviewed.

In reviewing the associated library reference, two potential deficiencies associated with QICAP were found:

(1) Depreciation reported in the National Consolidated Trial Balance is an inappropriate measure of the value of owned capital. To be specific, the depreciation reported in the NCTB is based on accounting period conventions not suitable for productivity accounts.[68]

(2) The Moody's composite of average yields on corporate bonds is used in arriving at the USPS cost of capital.[69] OCA witness Dr. Edwin Rosenberg (OCA-T-3) has indicated that the Postal Service can borrow from the U.S. Treasury at the cost of money plus 1/8 percent.[70]

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[67] USPS-LR-H-272.

[68] USPS-LR-H-272, "USPS Quarterly Total Factor Productivity Methodology, A Report to Charles Guy, Director, Office of Economics, USPS," L.R. Christensen Associates, January 1988.

[69] *Ibid.* at 47.

[70] OCA-T-3, Docket No. R2000-1.

In discussing Postal Service cost minimization, one is addressing certain operating procedures from the point of view of economic theory. The Postal Service approach to operations and pricing in terms of whether or not it maximizes its output can result in a very different situation than one in which efficient competitive equilibrium is sought.

From classical economic theory, an output maximizing company (in comparison to a profit maximizing/cost minimizing company) does not operate efficiently, achieving the equality of marginal cost with demand under different conditions than would occur under pure competition. Dr. William Niskannen's pioneering work on public organizations provided the microeconomic theory for an enterprise charged with public responsiveness and responsibilities.[71] He indicated that such an organization has a tendency to over-invest. It is interesting to note that a refrain in the Postal Service community is the need to grow volume and increase investment.

The benchmarking of corporate practices has been a major goal in the corporate sector in recent years as companies have attempted to become increasingly efficient. Witness Tayman, in commenting on investment policies, indicated that he was unaware of any benchmarking studies on investment standards relating to equipment in place.[72] Also, when requested, the Postal Service was unable to produce any internal documents prepared by or for the Postal Service evaluating the level of capital spending by its counterparts, either in other advanced industrial nations or by its major

[71] Niskannen, William A., *Bureaucracy and Representative Government*, Chicago, Aldine, 1971.

[72] Tr. 2/500-1.

competitors in the United States, such as FedEx or UPS. Moreover, Postal Service witness Kingsley has stated that there are no studies produced by or for the Postal Service since the beginning of 1998 evaluating its flat processing automation as compared to the automation achieved by its counterparts in other advanced industrial nations.[73] These responses tend to confirm that there are no benchmarking studies.

In a response to the interrogatory of the Association of American Publishers (AAP), the USPS recites Professor Panzar's direct testimony in Docket No. R97-1:

> However, the efficiency of the Postal Service operating plan is not an issue for the analyst. As long as it is given that postal services will be produced following Postal Service practices and procedures, the relevant marginal and incremental costs for pricing purposes are those calculated based on the Postal Service operating plan.[74]

It is clear that, on occasion, the USPS does not achieve its investment budget (apparently failing to meet plans) and has very limited, if any, analyses verifying whether such an investment budget is efficient. Accordingly, Toda's comments, introduced to this proceeding by Dr. Bozzo, are relevant. The behavior of a cost function that is not based on the theoretical assumptions of cost minimization and marginal productivity pricing is apparently a very different assumption from the cost minimization case. The impact on Dr. Bozzo's conclusions needs further explanation.

Toda's work was developed for the analysis of the Soviet economy. Soviet businesses appear to have been operated under an output-maximizing objective. In addition, the industries were under various governmental regulations in acquiring the

[73] ANM/USPS-T10-27, Tr. 5/1578.

[74] AAP/USPS-1, Tr. 21/8611.

factors of production, and the prices of finished goods and intermediate products were not set on a shadow price basis. Accordingly, a mixture of operating inefficiencies and improper pricing could theoretically arrive at a situation different from that obtained from an efficient competitive equilibrium.[75]

The Postal Service is a major purchaser of goods and services, and possibly even has some degree of monopsonistic power in the purchase of some types of specialized machinery as well as monopolistic competitive power in the sale of certain services. Therefore, Postal Service may, through its resource input, production, and operating decisions, affect factor prices. Accordingly, in achieving an economically inefficient factor allocation, the USPS may make purchasing and investment decisions that result in the distortion of factor prices, resulting in the generation of factor input prices different from those that would normally occur in a competitive environment. Dr. Bozzo did not address the implications for the labor demand function.

9. In conclusion, the theory underlying Dr. Bozzo's model has not been shown to be derived from the appropriate economic theory.

In my opinion, the Postal Service has not demonstrated that Dr. Bozzo's model is supported by appropriate economic theory. I have also noted deficiencies in the statement of the function being estimated, the selection of variables, the treatment of the network, the time frame, and cost minimization.

[75] Toda, *op.cit.* at 264. Dr. Toda actually found that some of the Soviet industries operated efficiently (a result he did not expect to find) and that some industries operated inefficiently. Regardless of the empirical findings, the theory is applicable insofar as it applies to firms that do not minimize costs. A partial explanation of Dr. Toda's empirical findings would be that the Soviet economy actually did, in some cases, operate efficiently.

C. Criterion 3: The Study Should Include a Discussion of the Modeling Approach and How It Is Consistent with the Underlying Data.

1. Another problem associated with Dr. Bozzo's work is his modeling of capital (as opposed to the accuracy of the QICAP variable itself). The use of capital affects future Postal Service costs.

Previous, current, and future investment efforts are important to the Postal Service and are focused on achieving productivity gains. The use of capital and the projection of the investment budget and efficiencies to be created has been highlighted by the Postal Service: "During 1999, the Postal Service continued its accelerated deployment of automation and mechanization equipment and software. This allowed us to increase our ability to place accurate barcodes on letter mail, while deploying additional equipment to sort the higher volumes of automated letter, flat, and package mail." [76]

(a) Dr. Hsiao has useful guidance on the modeling of capital and investment in economic models.

Dr. Hsiao's pioneering work on fixed effects has been referenced directly or indirectly throughout the analysis of volume variability.[77] A quote from the textbook *Econometric Models, Techniques, and Applications*, co-authored by Dr. Hsiao with Michael Intriligator and Ronald Bodkin, addresses the issue of capital in the econometric estimation process:

[76] United States Postal Service, *1999 Comprehensive Statement on Postal Operations* at 50.

[77] Cheng Hsiao, *Analysis of Panel Data*, Cambridge University Press, 1986. Another book referenced is *Econometric Models, Techniques, and Applications*, with Michael D. Intriligator, Ronald G. Bodkin, and Cheng Hsiao, Prentice Hall, 1996, Second edition.

...The inputs should, in theory, be measured in terms of *services* of the input per unit of time, but such data are generally not available, so they are instead typically measured by the amount of the input utilized or available in the production process. Labor input is typically measured as labor hours employed per year, but it is also sometimes measured as number of employees. Capital input is typically measured by the net capital stock (net of depreciation), but it is also sometimes measured by the gross capital stock and by certain direct measures (e.g., number of tractors in use for agriculture)....

Of these variables, the one that creates the most problems is the capital input. While data on output and labor are generally available, data on capital are either not available or of questionable validity. Enormously complex problems of measurement arise with respect to capital as an input to the production process. First, capital generally represents an aggregation of very diverse components, including various types of machines, plant, inventories, and so on. Even machines of the same type may cause aggregation problems if they are of different vintages, with different technical characteristics, particularly different levels of productivity or efficiency. Second, some capital is rented but most is owned. For the capital stock that is owned, however, it is necessary to impute rental values to take account of capital services. Such an imputation depends, in part, on depreciation of capital. Depreciation figures are generally unrealistic, however, since they entail both tax avoidance by the firm and the creation by the tax authorities of incentives to invest via accelerated depreciation. Third there is the problem of capacity utilization. Only capital that is actually utilized should be treated as an input, so measured capital should be adjusted for capacity utilization. Accurate data on capacity utilization are, however, difficult or impossible to obtain.[11] Other problems could be cited as well, but all these suggest that, if at all possible, the use of an explicit measure of the capital stock should be avoided, since it is virtually impossible to find data adequately representing capital stock.[78]

11 An early approach to capacity utilization was to assume that the percentage of capital utilized was the same as the percentage of labor utilized and thus to reduce the total capital available by the (labor) unemployment rate, as in Solow (1957). More recently, there are various methods used to adjust capital for the degree of utilization which are independent of the unemployment rate. For example, the Wharton capacity utilization rate method assumes 100% utilization at local peaks of the industry output series, with capacity assumed to grow linearly from peak to peak. Capacity utilization is then obtained as the percentage of output relative to the value obtained on the linearly interpolated capacity series.

78 Intriligator, Bodkin, and Hsiao, *op.cit.* at 284-85.

(b) Dr. Bozzo has not modeled capital in a way that would meet the criteria outlined by Drs. Intriligator, Bodkin, and Hsiao.

Dr. Bozzo's approach does not meet the criteria outlined in the above quote. Dr. Bozzo has no measure of capacity utilization in his equations. Mail processing is a factory batch processing/job shop type of process. In analyzing factory operations, capacity utilization has a strong impact on cost performance. This is a potentially very important variable omitted from the analysis. In addition, it is not clear whether capital is appropriately modeled as an exogenous variable (as I believe Dr. Bozzo has done), or as an endogenous variable in a simultaneous equation system.

On the subject of the capital variable, Dr. Bozzo indicates that:

> With respect to the capital variable, my inclusion of the capital quantity rather than price is appropriate for a treatment of capital as a "quasi-fixed" factor. While I would expect capital costs to be volume-variable to some degree (possibly to the same degree as labor costs as discussed in USPS-T-15 at pages 39-41), I would nevertheless expect that the nature of the Postal Service's capital planning and deployment processes is such that capital and labor are not simultaneously determined, but rather that the available capital is taken as a "given" when labor work assignments are made.[79]

Dr. Bozzo indicates that capital is neither exogenous nor endogenous;[80] such a situation is impossible. Accordingly, some review of the specification of the econometric estimating model is needed.

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[79] OCA/USPS-T-15-56(b), Tr. 15/6359.

[80] Tr. 15/6414.

2. Witness Degen's testimony is a major input to the understanding and modeling of postal mail processing.

Witness Degen presents information on the physical and operational nature of mail processing as related to volume variability:

> ...I show that the structure of mail processing operations does not support the assumption that volume-variability factors should uniformly equal 100 percent. My analysis of the structure of mail processing operations also reveals that the pooled regression approach advocated by OCA witness Smith and the cross-sectional analysis favored by UPS witness Neels, in Docket No. R97-1, potentially ignores (sic) features of the Postal Service network and operations that are vital to distinguishing the cost effects of volume changes from the effects of non-volume factors.[81]

Mr. Degen raises two important issues in his testimony[82]:

- Mail processing operations have cost causing characteristics related to their location, service area, and role within the Postal Service's network that will not change as a result of a small, sustained increase in volume.
- For a small, sustained, and representative increase in national RPW, all other factors remaining the same, volume will increase workload in all, or nearly all, plants.

Witness Degen's discussion of the postal network--the ways in which the mail processing plants interact--suggests that volume variability should more appropriately be evaluated at the plant or inter-plant facilities network level, rather than in terms of activity costs on the mail processing plant floor. In examining the current Postal Service

[81] USPS-T-16 at 4, line 23 through 5, line 6.

[82] USPS-T-16 at 6, lines 18-23.

network, he notes in Section 2 of his testimony that over 30,000 post offices and other delivery units are networked, with mail processing being performed in large plants as well as other offices. He indicates that plants can sort mail as well serve as intermediate trans-shipment and processing points for various sections of the network.

In addition, the 21 Bulk Mail Centers (BMCs) constitute a separate network of processing facilities for specialized Standard Mail (A) and (B). BMCs sort incoming Standard Mail parcels to 5 digit ZIP codes for delivery units in their service territories, and also sort outgoing parcels to other BMCs. The role of BMCs in processing non-parcel Standard Mail (A) varies, but it usually involves sack, tray, and bundle sorting and the cross-docking of pallets (no piece sortation of letters and flats). Mr. Degen indicates that the network of processing plants is not static, but has involved the addition of nodes as the nation has grown and its population distribution has changed.

Mr. Degen concludes in Section 3 of his testimony that national volume growth affects the workload in the entire network. He states, "The geographic distribution of increase in national volume, and hence of volume-related workload growth, for mail processing plants, is a key element of my analysis of the relationship between mail processing labor costs and mail volumes." He continues "...I must conclude that the additional volumes will cause workload growth throughout the network."[83]

Mr. Degen's testimony reinforces my conclusion that postal costs are strongly influenced by the interaction of mail processing plants and that the longer-run analysis of the relationship between cost and volume is appropriate--*i.e.* considering volume, not

[83] USPS-T-16 at 15, lines 9-12 and at 15, lines 20-21.

in terms of its behavior in any one processing plant, but rather on an overall basis as volume is adjusted: such an approach would look at the effect of a change in volume on total cost. Accordingly, the "between" analysis presented by Dr. Bozzo, based on the arithmetic means of cost data appears to be more appropriate than is a fixed effects approach. Theoretically, one strives to more closely attain the estimation of longer-run costs (the types of costs that would vary as the nodes of the network changed as delineated by Mr. Degen), rather than the short- run cost estimation presented by Dr. Bozzo.

In Section 5 of his testimony, Mr. Degen extensively presents a graphical analysis of the impact of volume growth. To quote Mr. Degen:

> In questioning Dr. Bradley on his testimony in Docket No. R97-1, the Commission used a plot of TPH and hours from the manual letter cost pool to imply that visual inspection of the plot indicated 100 percent volume-variability for that cost pool. Dr. Bozzo thoroughly addresses the issue of graphical representation and analysis of the MODS data in his testimony, but I would also like to discuss it here because the pictures succinctly illustrate how ignoring non-volume characteristics of plants can lead to a biased, misleading understanding of the hours-volume relationship. [84]

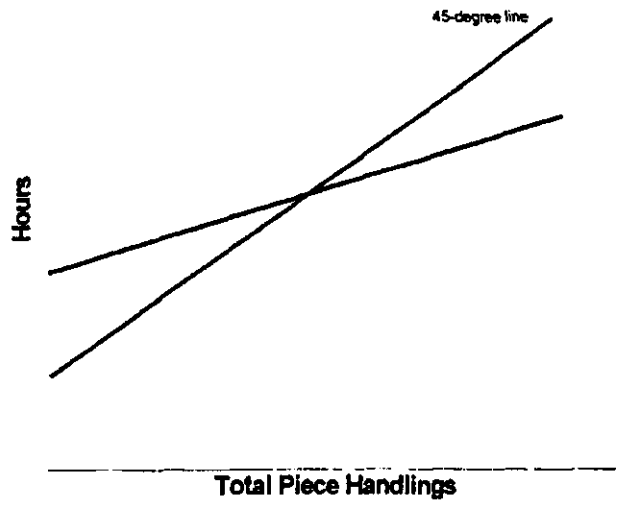
Mr. Degen maintains that a graph of hours against volume can result in the erroneous conclusion that hours will vary in direct proportion to volume. The error, in Mr. Degen's opinion, is caused by the absence of information on network and plant characteristics. However, the argument for 100 percent volume variability is visually compelling, as will be discussed subsequently.

[84] USPS-T-16 at 24, lines 6 through 13.

The issue of the correct estimation of volume variability is best addressed by examining Mr. Degen's graphs.[85] Mr. Degen's graphs can be used to justify any of the three techniques under consideration in this case—fixed effects, pooled, or "between." As will be shown, the fixed effects approach is unsuitable: a simple review of the data shows that the eye (and economic logic) suggests the fixed effects approach is wrong.

Figure 1 of Mr. Degen's testimony, reproduced here, shows the "true" cost structure of a mail processing operation for a hypothetical mail processing plant. By "true" or "underlying" cost structure he means the systematic, non-stochastic component of the hours/pieces relationship.

Figure 1
The Underlying Cost Structure for a Plant



[85] I do not imply that Mr. Degen would agree with any of my analysis; I would expect him to disagree. I use his graphs to show that a convincing argument can be made for the possibility of essentially 100 percent volume variability.

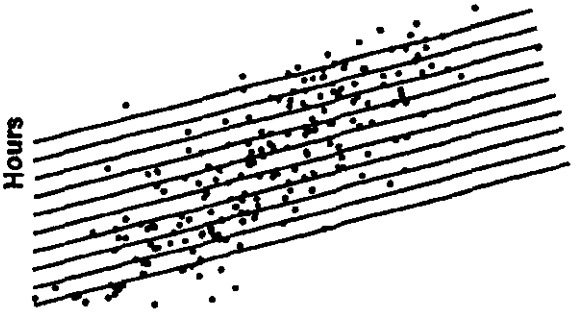
Volume variability is less than 100 percent for the hypothetical plant in Figure 1.[86] At some times during plant operation, the plant will be operating at relatively high volume (suggesting a high level of capacity utilization), and at other times the plant will be at a lower volume of TPH (with a lower level of capacity utilization).

Figure 2
Observable Data from the Underlying Cost Structure with Random Noise for One Plant

In Figure 2 of his testimony, Mr. Degen shows simulated sample data for the same plant generated by adding random noise to the underlying hours and pieces relationship plotted in Figure 1.

[86] This is exactly what one would expect, given that this is a short-run diagram relating small changes in hours and TPH.

Figure 3
Data for Ten Plants with Similar Cost Structures
but Different Levels of Efficiency
Illustrating True Cost Structure

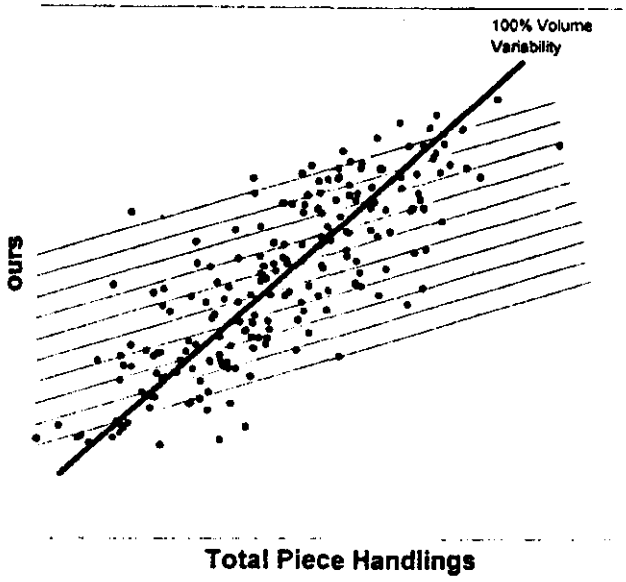


Total Piece Handlings

Mr. Degen's Figure 3 presents ten plants with cost structures similar to the plant in Figure 2, but with different levels of efficiency.[87] For each plant, Mr. Degen plotted a line analogous to that plotted in Figure 1. Accordingly, there are ten sets of points and ten lines, all of them short run.

[87] Mr. Degen and Dr. Bozzo attribute the differences in efficiency to differences in networks and other factors not associated with volume of mail. Nevertheless, the Postal Service has extensive testimony and comments on investment and efforts to achieve lower costs. Treating these fixed effects factors as exogenous rather than endogenous to the capital investment process seems to be wrong.

Figure 4
Data for Ten Plants with Similar Cost Structures
but Different Levels of Efficiency
Illustrating Misinterpretation of Cost Structure



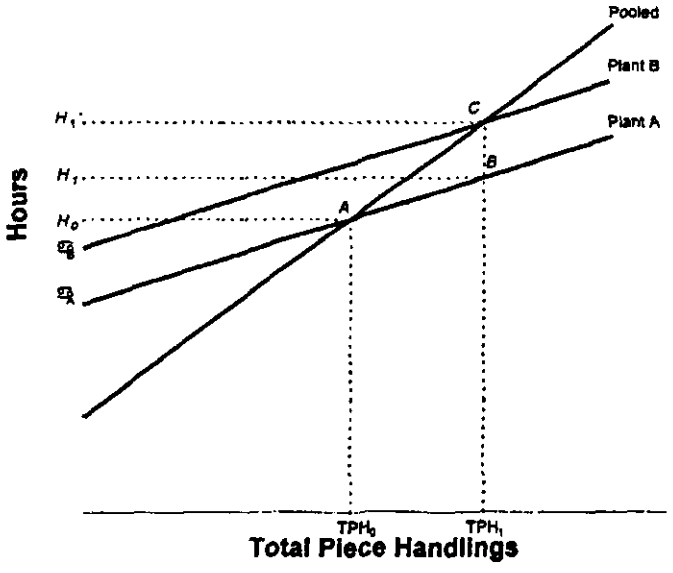
1 In Figure 4, the lines presented in Figure 3, which represented the formerly
2 examined short-term hypotheses of the relationship between hours and pieces, are
3 suppressed. An overall trend line is added to the diagram. Instead of visualizing the
4 data as in Figure 3--ten separate lines for ten facilities--the data are considered on a
5 combined basis.[68]

[68] Mr. Degen's title for Figure 3, referencing the "true cost structure," is correct in the sense that the cost structure is short run. Similarly, the title for Figure 4, referencing a "Misinterpretation of Cost Structure," was included in the reproduced figure, but, in contrast to Mr. Degen, I believe that the true cost structure is the line he has labeled "100% Volume Variability".

Whatever interpretation one wishes to give to the data is dependent on which lines one looks at--*i.e.* one could derive a fixed effects model from Figure 3; or alternatively one could define a pooled model from a review of Figure 4, recognizing that additional variables would be needed and that any two variables approach is inadequate insofar as it may omit important information.

From a review of the graphs, two distinctly different alternatives are possible. The conclusion from the underlying model is essentially determined once one has specified the choice of model; all that then remains is the model estimation. The issue is then the selection of the appropriate line for estimation.

Figure 5
Analysis of Response to Volume Growth



Turning to Mr. Degen's Figure 5, two plants are examined: Plant A and Plant B. Assume that Plant A is designed and sized correctly, based on Mr. Degen's theory of the mail processing network. Assume that optimal capacity is at "A", but that the plant frequently operates in the short run, and the line shows these various levels of operation. Assume that Plant B is designed and sized correctly for a higher level of TPH, and that the optimal capacity is at point C. Again, on a short-run basis the plant may operate anywhere along the line. The two most important points in the diagram are points A and C. They represent the real labor costs of processing mail at each of the plants when operating at plant design capacity--the level for which they were designed, based on the evolving mail processing network as described by Mr. Degen.

Figure 5 has two types of plots in it. The facility by facility plots (labeled "Plant A" and "Plant B") are the types of plots that both Dr. Bradley and Dr. Bozzo generate and estimate. These are short-term plots of data. Alternatively, one could allow for the treatment of the data on a pooled basis or cross sectional basis. In that case, one would estimate the line AC. Such a modeling approach would be consistent with the data and an underlying longer-term capacity expansion path.

The mail-processing network consists of over 300 plants. Accordingly, there are variously sized plants, and in a real world environment costs exhibit stochastic properties. A pooled regression line could be generated. It would be based, not on two plants, but based on confirmed data from approximately 300 plants. Alternatively, a cross sectional regression line based on the arithmetic means of the plants could be generated. The appropriate econometric techniques and variables would need to be accounted for in order to avoid problems of omitted variables. The results could be 100

percent volume variable, or some other number either greater than (or less than) 100 percent volume variable. The results would not be known until the appropriate variables were used. Such an analysis correctly using all relevant variables has not yet been performed in this case. However, on a preliminary basis, there are the pooled and "between" regressions in Dr. Bozzo's testimony, which are unsatisfactory but also the best currently available.

Of the approaches presented by Dr. Bozzo, it would appear that the cross sectional approach may be the "least bad." For each mail processing plant, the data are averaged (i.e., a mean is determined); a regression analysis is then performed on the sites. This is a cross sectional approach, and based on Mr. Degen's testimony, appears to be superior to either the fixed effects or pooled models. It examines costs as plant size varies, based on the plants sized for the postal network.

The results from the various models considered by Dr. Bozzo are set forth in Table 5. I have indicated that the "between" model, a type of cross sectional model generated by Dr. Bozzo, is the "least bad" of the models. In general, cross sectional data are assumed to show a longer-run equilibrium, and the line has all of the plants--*i.e.* all of the cross sectional data--thereby having both short-term and longer- term aspects. The major statistical problems associated with the model have been well documented. However, at this point, it is the only model "left standing." Accordingly, if the Commission should conclude that some action is necessary in adopting a model, I find this to be the "least bad" model. I do not recommend adoption of the "between" model in view of the underlying problems with the data and the study. I recommend adoption of 100 percent variability until a different approach is shown to be reasonable.

Table 5
Variabilities--Dr. Bradley, Fixed Effects, Between, Pooled, and Random

Variabilities Using Different Methods

Activity	Dr. Bradley	Dr. Bozzo Fixed Effects	Dr. Bozzo Between	Dr. Bozzo Pooled	Dr. Bozzo Random Effects	Total Cost $--000
BCS Sorting	0.945	0.895	1.044	0.931	0.916	1,043,841
OCR Sorting	0.786	0.751	1.101	0.862	0.821	219,070
FSM Sorting	0.918	0.817	1.026	0.913	0.880	1,042,369
LSM	0.905	0.954	0.913	0.922	0.918	78,765
SPBS Non Priority	0.469	0.641	0.889	0.724	0.662	283,275
SPBS Priority	0.802	0.641	0.889	0.724	0.662	82,447
Manual Flats	0.866	0.772	0.963	0.842	0.803	459,933
Manual Letters	0.797	0.735	0.906	0.845	0.790	1,563,963
Manual Parcels	0.395	0.522	0.730	0.645	0.615	60,593
Manl Priority Sorting	0.448	0.522	0.748	0.642	0.627	259,762
Cancl. And Mail Prep	0.654	0.549	0.845	0.643	0.569	295,957
Total						5,389,975

Attributable Costs Based on Various Variabilities

	Total Cost $--000	Dr. Bradley $--000	Dr. Bozzo Fixed Effects $--000	Dr. Bozzo Between $--000	Dr. Bozzo Pooled $--000	Dr. Bozzo Random Effects $--000
BCS Sorting	1,043,841	986,430	934,238	1,089,770	971,816	956,158
OCR Sorting	219,070	172,189	164,522	241,196	188,838	179,856
FSM Sorting	1,042,369	956,895	851,615	1,069,471	951,683	917,285
LSM	78,765	71,282	75,142	71,912	72,621	72,306
SPBS Non Priority	283,275	132,856	181,579	251,831	205,091	187,528
SPBS Priority	82,447	66,122	52,849	73,295	59,692	54,580
Manual Flats	459,933	398,302	355,068	442,915	387,264	369,326
Manual Letters	1,563,963	1,246,479	1,149,513	1,416,950	1,321,549	1,235,531
Manual Parcels	60,593	23,934	31,630	44,233	39,082	37,265
Manl Pri Mail Sorting	259,762	116,373	135,596	194,302	166,767	162,871
Cancl and Mail Prep	295,957	193,556	162,480	250,084	190,300	168,400
Total	5,389,975	4,364,418	4,094,231	5,145,960	4,554,704	4,341,106

3. Witness Degen's testimony is consistent with the application of intuition and common sense that indicates the volume variability for mail processing approaches 100 percent.

The above analysis of Mr. Degen's testimony is substantiated if the problem is looked at from simply the perspective of intuition and common sense.

In addressing the issue of data and modeling, Dr. Bozzo states in his testimony:

> During the hearings on the Postal Service's direct case in Docket No. R97-1, Chairman Gleiman asked Dr. Bradley to confirm the intuition
>
> > ...that if costs vary 100 percent with volume, the graph of those costs and the volume data points should resemble a straight line with a 1-to-1 slope. Docket No. R97-1, Tr. 11/5578 at 4-6.
>
> Dr. Bradley agreed, and even added that the line should go through the origin (Id., at 8-9, 11).[21] In my opinion, Dr. Bradley should not have confirmed Chairman Gleiman's intuition. It has been understood since Docket No. R71-1 that to measure "volume-variability," it is necessary to hold constant the non-volume factors that affect costs.[89]

21 Dr. Bradley's statement that the line should additionally pass through the origin was in error. As a general matter, the cost surface passing through the origin is neither necessary nor sufficient for the 100 percent volume-variability result.

Dr. Bozzo apparently believes that the multivariate nature of the modeling process makes the bivariate graphs irrelevant. However, the graphs are visually compelling in showing that hours and TPH vary together closely. The Appendix contains plots of the number of hours and TPH for some of the mail processing activities studied by Dr. Bozzo. Dr. Bozzo has referred to Dr. Bradley's data, so the graphs are based on Dr. Bradley's data. The graphs are open to the same criticisms

89 USPS-T-15 at 59, lines 4 through 13.

voiced in Docket No. R97-1. Only two pieces of data are plotted. However, all of the information actually contained in Dr. Bradley's data set and which was actually collected from the field operations (and remaining after his scrubbing) is also present, recognizing that data are not denoted by accounting period. Data were obtained from Dr. Bradley's data set in order to be consistent with Dr. Bozzo's comments. I have previously concluded that the plots are consistent with a high degree of volume variability, possibly even 100 percent volume variability. This is a simple and intuitively plausible initial conclusion. This would appear to be the case for a number of the activities. An ordinary least squares line (which does not consider any of the myriad of issues associated with serial correlation, lack of variables, times series nature of the data, omitted variables, etc.) has the characteristics presented in Table 6.[90]

Table 6
OLS Summary by Selected Activities

Activity	Regressor	RSquare
OCS	0.19	0.77
BCS	1.01	0.94
LSM	0.98	0.97
FSM	1.01	0.96
MANL	1.05	0.90
MANF	1.09	0.90

The regression lines are econometrically indefensible insofar as the regression does not consider the myriad of issues that contribute to the understanding of the TPH/hours relationships. However, the lines do show that a simple visualization of a straight line through the data suggests a high level of volume variability, resulting in a high R

[90] The regression runs are provided in Library Reference OCA-LR-I-2.

square. A modeling approach consistent with the data would be the "between" model or the pooled model.

4. In terms of identifying a major factor driving cost, intuition appears reasonable.

Dr. Bradley's analysis included a large number of variables in addition to hours and TPH. There is, however, a difference between the number of variables and the amount of information presented. All of the variables were either derived from the scrubbed data of hours and TPH via cross products, or were simply time trend or dummy variables. Except for time trend and seasonal information, the actual data show that TPH and hours vary together closely.

The issues under consideration are the correct estimation of the relationship, appropriate variables, the underlying methodology, and whether such estimation would yield 100 percent variability. The graphs derived from the application of intuition are compelling and suggest the existence of a relationship for high volume variability, probably at or approaching 100 percent. A correctly constructed econometric model might also reach such a conclusion.

5. In conclusion, Dr. Bozzo's choice of econometric model is inconsistent with the economic modeling of the postal process.

The level of econometric sophistication evidenced previously by Dr. Bradley and currently by Dr. Bozzo is clear. The major concern with their econometric estimation work is the inappropriate choice of a model for estimation. The "between" model is the more appropriate model at this time. The microeconomic assumptions underlying Dr. Bozzo's econometric model are at best muddled. We are faced with analyses of non

cost minimizing firms, cost functions that have become labor demand functions, and state of the art price theory which is not organized in a coherent fashion or logical progression. Furthermore, the underlying data are deficient, both in terms of variables omitted and variables included (such as QICAP and the manual ratio).

D. Criterion 4: A Correct Estimation Procedure which Is Suitable to the Estimation Needs at Hand Should Be Used.

1. The "between" model is currently the "least bad" model available.

The deficiencies of the fixed effects approach as it has been applied have been outlined in Docket No. R97-1, where it was rejected. Dr. Bozzo's overall approach is fundamentally identical to that of Dr. Bradley. Accordingly, the fixed effects model is unsuitable at this point.

Deficiencies in the availability of variables also render an application of the pooled model unsatisfactory. Without a measure of capacity, capital, and networks (among other variable deficiencies), the pooled model is subject to specification error.

The use of cross sectional models allows for an analysis of costs as facilities vary. The "between" model has data available on a cross sectional basis, but the model is subject to deficiencies in the set of variables available. There have been a number of criticisms of the econometric estimation deficiencies of the "between" model, as outlined by Dr. Bradley. However, the "between" model permits an analysis of labor demand based on size of the facilities. Accordingly, the "between" model has relevance to the current proceeding and is the "least bad" model.

In addition to deficiencies in Dr. Bozzo's current models, several major areas of the methodology need potential improvement. First, at the activity level, investment

almost certainly has a major impact on the costs. However, investment is, in turn, a function of TPF or TPH, so in a sense investment is an endogenous variable to the mail handling process. It may be appropriate to model simultaneously both investment and labor hours. Dr. Bozzo has not examined this area. Second, Dr. Bozzo's model treats each activity as if it were independent of every other activity in the mail processing plant. However, one would expect the efficiency, labor usage, investment requirements, and network aspects of the ten activities modeled to be significantly interrelated. This potential interrelationship could be due to some sharing of the workforce, the management, or the facilities. It is difficult to imagine that the cost of performing work in one activity is independent of other work performed in the plant.

2. In conclusion, Dr. Bozzo has not adopted a correct estimation procedure.

Dr. Bozzo's fixed effects approach is not acceptable. Assuming that the data could be improved, the appropriate variables developed, and a clear economic theory could be stated, one could perform the modeling effort using a pooled approach; but such an approach is not appropriate at this time. Accordingly, we are left with the "between" case as the "least bad." However, in view of the many uncertainties I have discussed, I do not view its adoption as appropriate.

On a longer-term basis, alternative modeling formations need to be considered, both in terms of the interrelationships of activities and whether some simultaneous estimation of investment and cost is appropriate. In modeling activities, the incidence of costs as a result of First Handling Pieces rather than TPF or TPH should be

examined. In summary, it is not yet even clear what the best modeling approach would be, but it is clear that there are a number of options that need to be explored.

E. Criterion 5: Results for Econometric Equations and Alternative Econometric Analyses Should Include a Discussion of the Values, Signs, and Other Relevant Information for the Variables.

Dr. Bozzo presents a variety of alternative econometric analyses, but they are all variants on his preferred methods. Fundamental changes and new modeling approaches have not been explored. Accordingly, while it is difficult to say that Dr. Bozzo has ignored Criterion 5, strictly speaking; it is also clear that this requirement needs to be applied to the study after the study has been redone. First, there needs to be a rework of the economic theory—with an improvement in presentation and more likely an exploration of multiple product production, simultaneous determination of output and investment, and an improved microeconomic analysis. Second, there needs to be a significant upgrading of the quality and availability of data. Finally, there needs to be the application of suitable estimating techniques. Therefore, the most important analyses have not yet been performed and any discussion at this time of values, signs, or other relevant information for variables is moot.

VII. CONCLUSIONS

A. Variabilities Were Traditionally Assumed To Be 100 Percent. The First Study, Performed by Dr. Bradley, Was Seriously Deficient.

The Commission has always applied a variability of 100 percent when attributing mail-processing costs. In Docket No. R97-1, the Postal Service reviewed the policy and presented a witness, Dr. Bradley, who proposed a new econometric model for mail processing operations to measure volume variability. That model purported to analyze the change in the estimated volume of mail processed with the estimated hours of labor required to process that volume. From this, he calculated the percentage change in labor hours for mail processing for each percentage change in the volume of mail, arriving at an estimate of volume variability. He concluded that the resulting volume variabilities for each of the several cost pools could be applied by Postal Service witness Degen. Dr. Bradley's volume variabilities were significantly lower than 100 percent, and the Postal Service contended that his variabilities should be applied rather than the traditional 100 percent variability used by the Commission.

Numerous objections were raised to Dr. Bradley's model specifications, his choice of regression techniques, and his handling of the data prior to running his regressions. The Commission's recommended decision specifically rejected Dr. Bradley's approach on several grounds and indicated that additional study was necessary before the Commission revised its approach to mail processing variability.

The Commission found fundamental deficiencies in the specifications for Dr. Bradley's model and discussed these problems in both its opinion and in greater detail in Appendix F to the Opinion. The Commission recognized that Dr. Bradley's model

failed to consider the impact of capital. The Commission noted that Dr. Bradley did not base his analysis upon a correctly specified cost function as indicated by the theory of production. The Commission also faulted Dr. Bradley's method of preparing the data for analysis, citing his several seemingly arbitrary restrictions and over-zealous scrubbing of the data prior to running regressions. The Commission recommended alternative approaches and further analysis. Finally, the Commission clearly indicated the fixed-effects model selected by Dr. Bradley in lieu of other possible regression models such as the pooled or the "between" model was not sufficiently supported and, in fact, had numerous infirmities.

B. Dr. Bozzo's Study Is also Seriously Deficient.

The Postal Service has now presented Dr. Bozzo's testimony that further analyzes mail processing costs, critiques Dr. Bradley's study, and responds to the Commission's R97-1 Opinion. Significantly, Dr. Bozzo reviewed the work of Dr. Bradley and that of other witnesses in Docket No. R97-1 and found that some criticisms of Dr. Bradley's work were valid. In response, Dr. Bozzo modified the methodology of Dr. Bradley.

While Dr. Bozzo purports to present a study meeting the objections expressed by the Commission in Docket No. R97-1, closer inspection indicates a startling similarity to the Postal Service's prior presentation that has been soundly rejected by the Commission. Dr. Bozzo continues to ground the analysis on the fixed effects regression model that the Commission essentially rejected in the Docket No. R97-1 opinion. Dr. Bozzo dresses up Dr. Bradley's defective cost function, renaming it a labor

demand function. He adds at least two variables affected by volume, "QICAP," and the heretofore unmodeled "network" characteristic. According to Dr. Bozzo, neither variable has ever been utilized by the Commission in considering segment 3 costs. The new Postal Service model is essentially Dr. Bradley revisited. Thus, without more, the Commission is faced with continuing to apply the traditional 100 percent volume variability to the ten cost pools.

The Commission may wish to attribute mail-processing costs for the ten cost pools on the basis of a variability analysis other than that in Docket No. R71-1 on which the Commission has based its traditional approach. Having independently reviewed the mail processing information and data supplied by the Postal Service and applied the appropriate classical economic theories, I conclude that upon the information now available, the cross sectional "between" model is the "least bad" of the models presented, although I do not advocate its adoption. In fact, the "between" model results in costs that are 95 percent attributable; the use of the model, which is known to be subject to error is, therefore, hardly worth the effort.

I recommend, instead, that the Commission reject Dr. Bozzo's study and continue to apply the traditional variability to the ten cost pools in the study. Alternatively, I recommend the "between" model as the "least bad" of the models presented by Dr. Bozzo. I provided OCA witness Thompson the list of those cost pools which should be modified to reflect a volume variability of 100 percent.

C. The Work that Has Been Reviewed Represents the Latest Part of a Major Modeling Effort.

Apparently, Dr. Bradley and Dr. Bozzo on a combined basis have spent approximately ten person years on the issue, and Dr. Bozzo has projected that there would be a significant additional effort involved in the completion of the work. The underlying economic theory is not set forth as clearly as is desired, so it is possible that there would be substantial theoretical modifications in the work as well as the extension of the work to additional activities, additional types of mail processing facilities, additional and/or improved data, and different estimating approaches.

I have discussed the work in terms of some of the criteria for evaluation set out in Appendix F of the Commission's opinion in Docket No. R97-1. By those standards, the work is not yet complete. Nevertheless, we are faced with the distressing fact that substantial effort as well as significant elapsed time has occurred with no production of a final study. I recommend that the Commission and the Postal Service consider the establishment of a working group to discuss, evaluate, and comment on theoretical, data, and modeling approaches in an effort to bring these issues to a conclusion. Obviously such a group would require the honest and effective participation of all of the parties involved.

Whether through a working group or otherwise, there are a number of deficiencies in the work to be addressed. First, the underlying economic assumptions need to be presented in a more comprehensible manner, with particular emphasis focused on assumptions about homotheticity, economic efficiency, networks, and the nature of the function being estimated.

Second, there need to be improvements in the data, particularly as related to the variables QICAP, manual ratio, and capacity utilization. It is important that the relationship of the investment data to the activity being estimated is carefully considered (if the activity approach is pursued). Even if the QICAP variable were not meaningless, it would not measure the level of capital associated with an activity in its current state.

Third, additional explanatory variables may be needed, particularly in terms of the network.

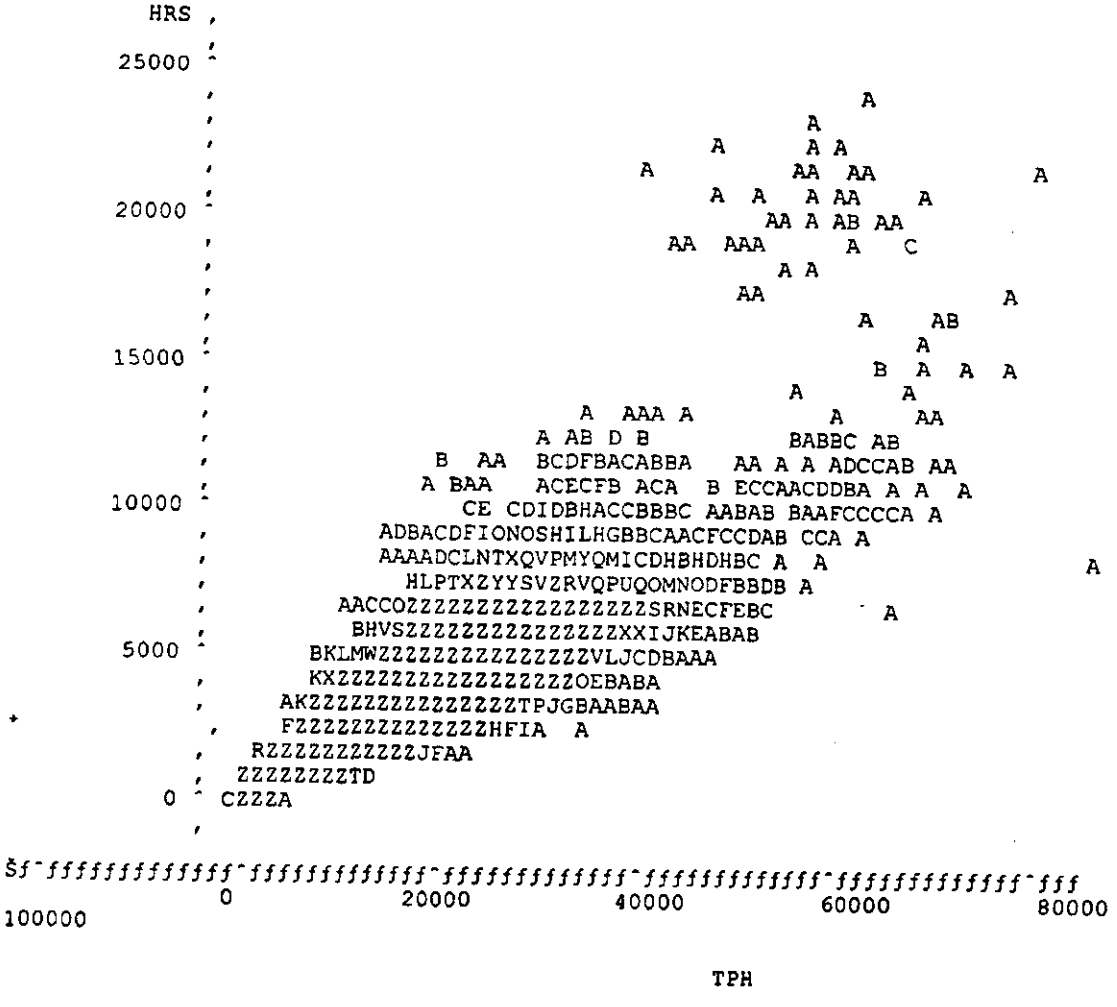
Fourth, recognizing the network aspects and longer run aspects of the mail processing process, the short-run fixed effects analysis presented is unsuitable; a longer-run analysis is needed.

Finally, my comments are based on a four-month examination of Dr. Bozzo's work. This is the necessary consequence of the time constraints of a rate case, but is not adequate from a scientific analysis point of view. Accordingly, I urge the Commission to recommend the establishment of a working group to consider this issue in detail.

APPENDIX

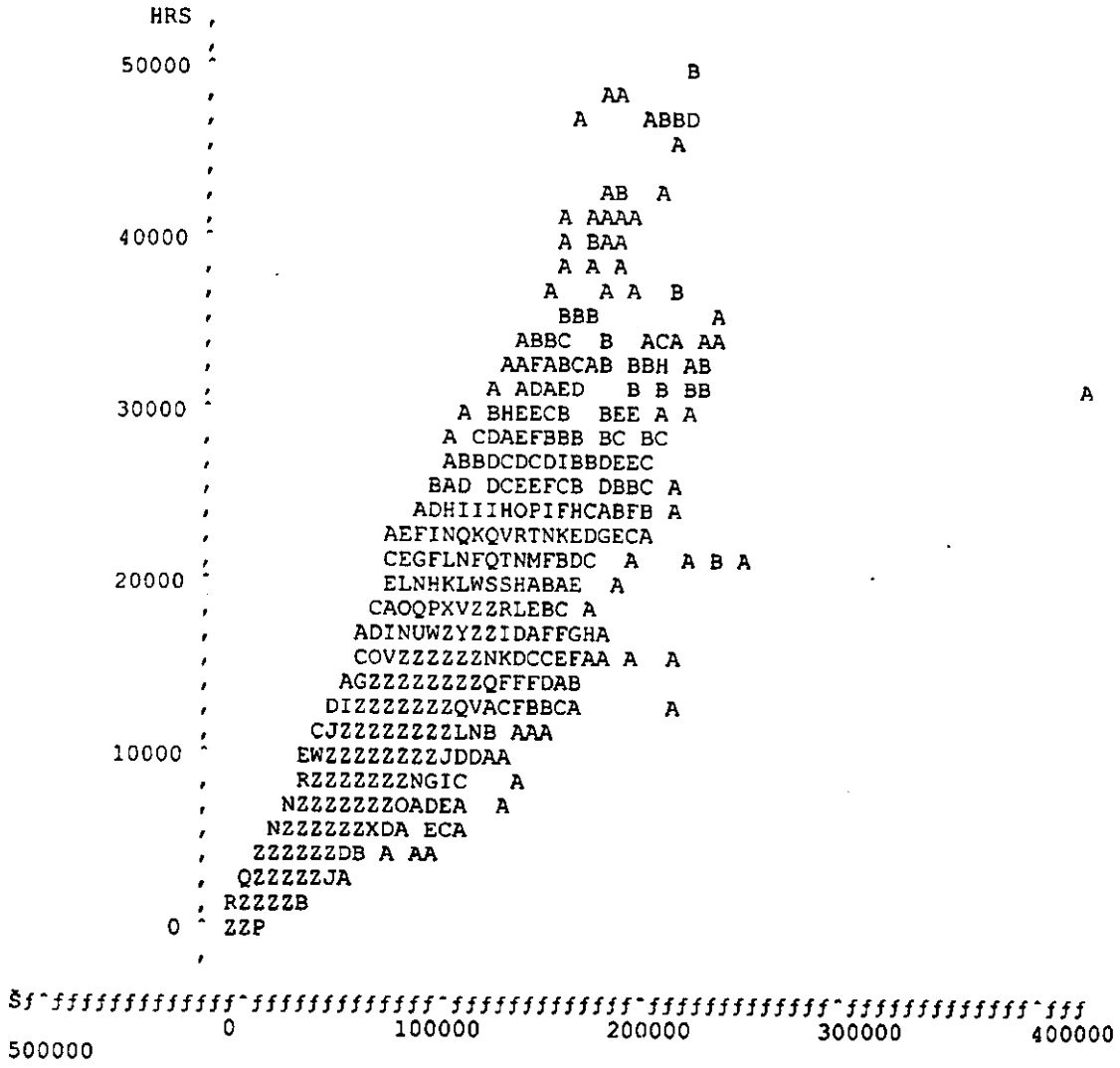
OCR OPERATIONS/ HOURS ON TPH
USING ONLY CONTINUOUS DATA FROM 8801-9613
INCLUDING OFFICES @ LEAST 39 OBS/LAG MODEL
USES 12 AP DUMMIES TO CAPTURE SEASONAL EFFECTS

Plot of HRS*TPH. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 13796 obs hidden.

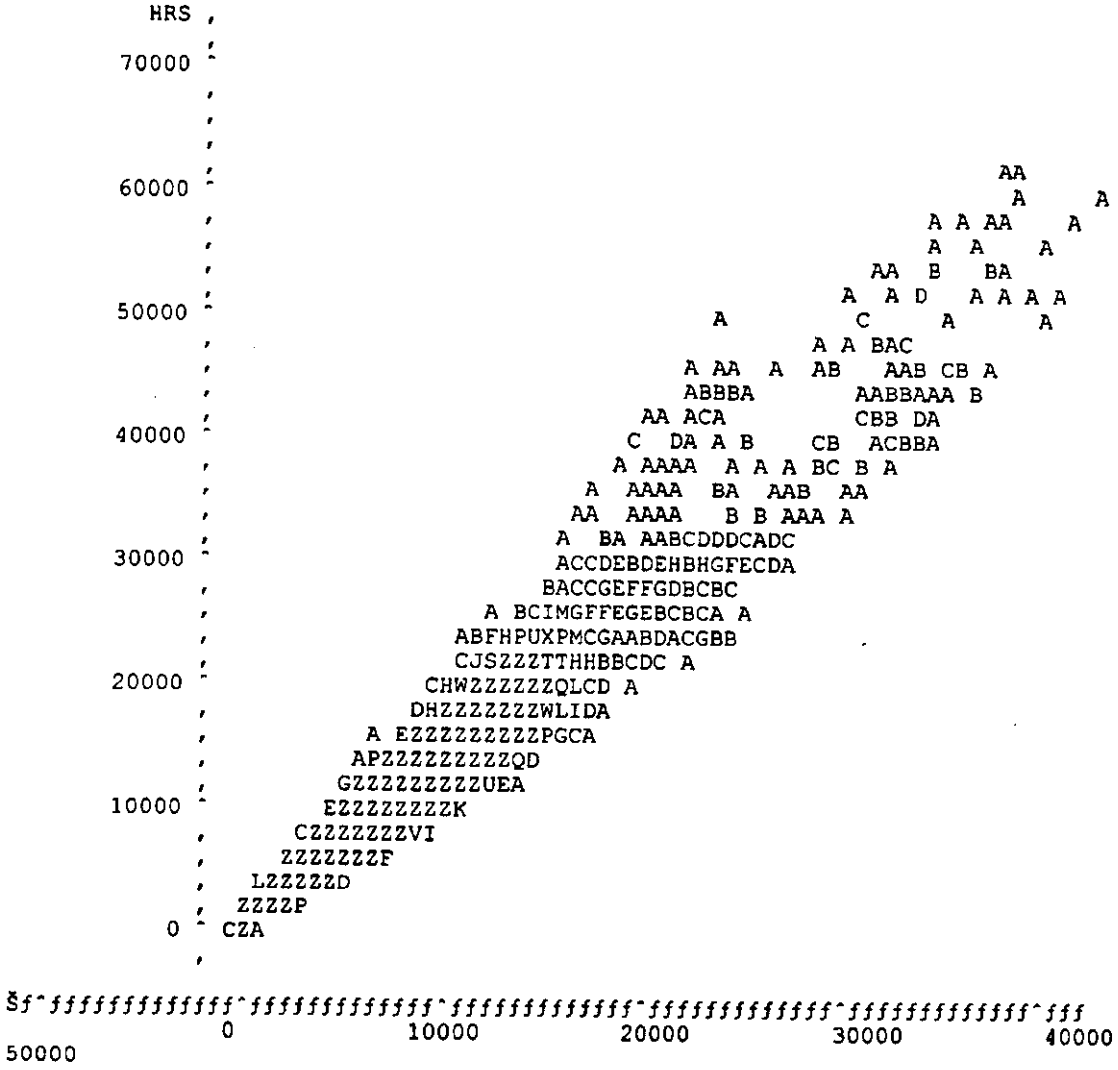
BCS OPERATIONS/ HOURS ON TPH
USING ONLY CONTINUOUS DATA FROM 8801-9613
INCLUDING OFFICES @ LEAST 39 OBS/LAG MODEL
USES 12 AP DUMMIES TO CAPTURE SEASONAL EFFECTS
Plot of HRS*TPH. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 19005 obs hidden.

FSM OPERATIONS/ HOURS ON TPH
USING ONLY CONTINUOUS DATA FROM 8801-9613
INCLUDING OFFICES @ LEAST 39 OBS/LAG MODEL
USES 12 AP DUMMIES TO CAPTURE SEASONAL EFFECTS

Plot of HRS*TPH. Legend: A = 1 obs, B = 2 obs, etc.

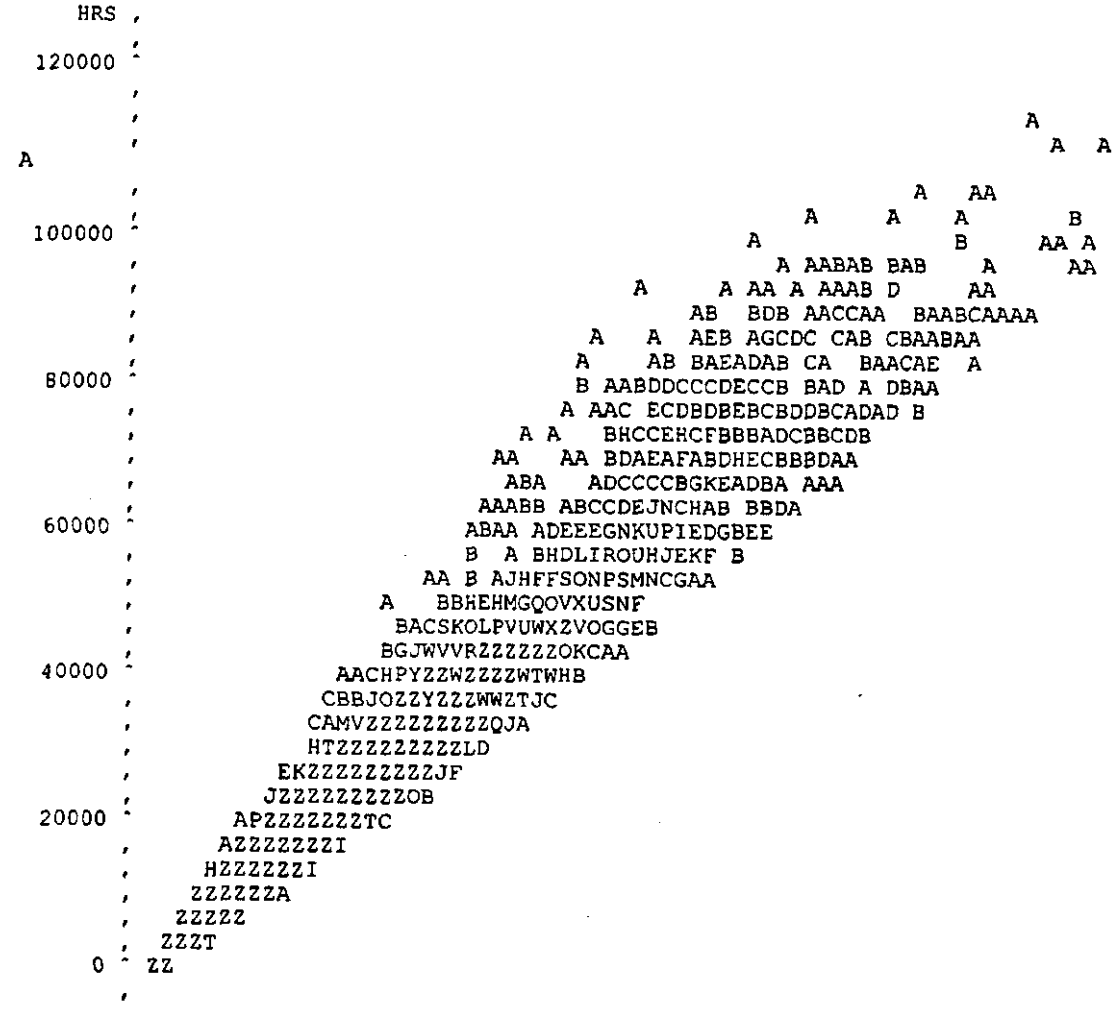


NOTE: 15019 obs hidden.

Docket No. R2000-1

OCA-T-4
Appendix

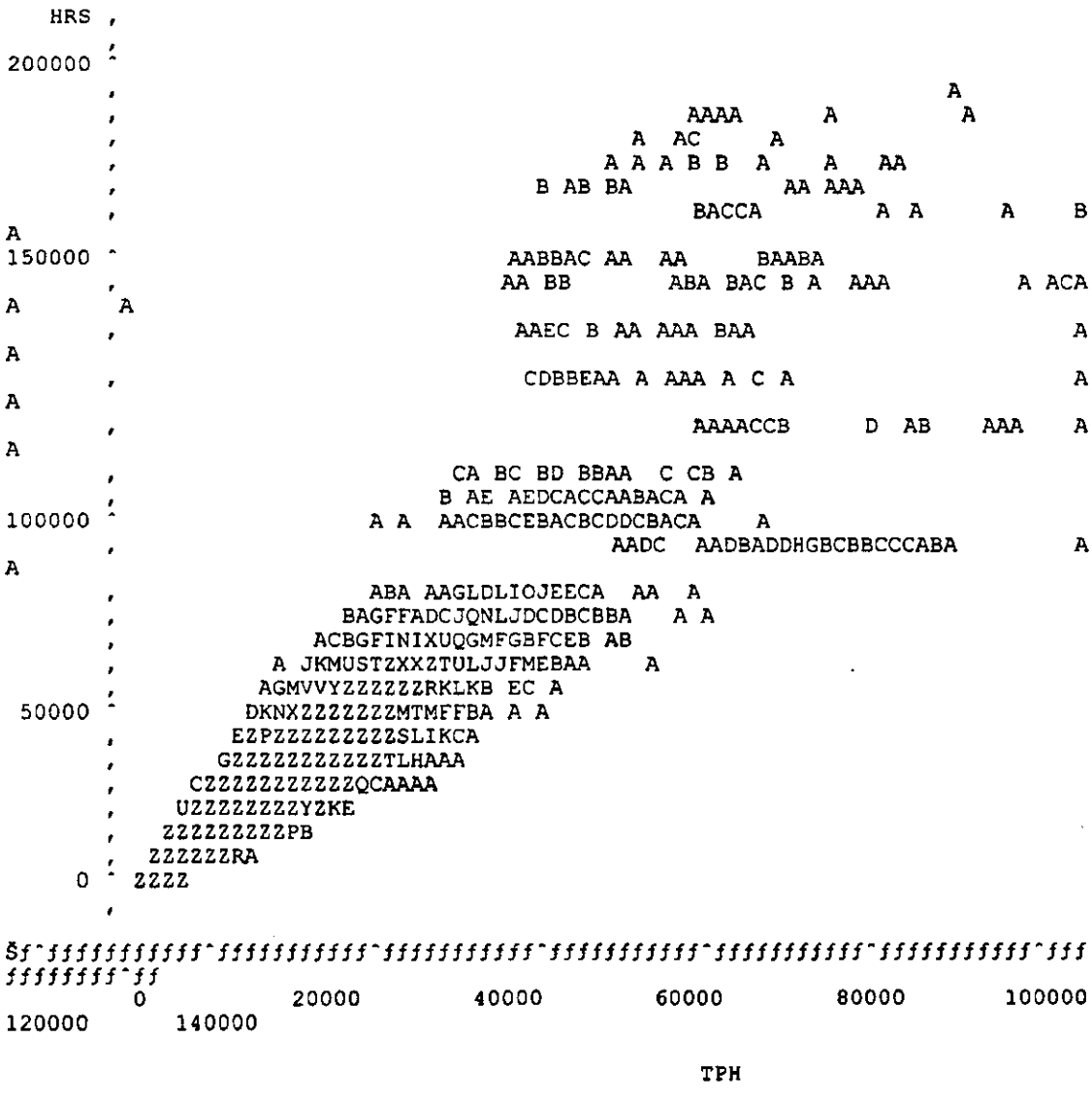
LSM OPERATIONS/ HOURS ON TPH
USING ONLY CONTINUOUS DATA FROM 8801-9613
INCLUDING OFFICES @ LEAST 39 OBS/LAG MODEL
USES 12 AP DUMMIES TO CAPTURE SEASONAL EFFECTS
Plot of HRS*TPH. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 15313 obs hidden.

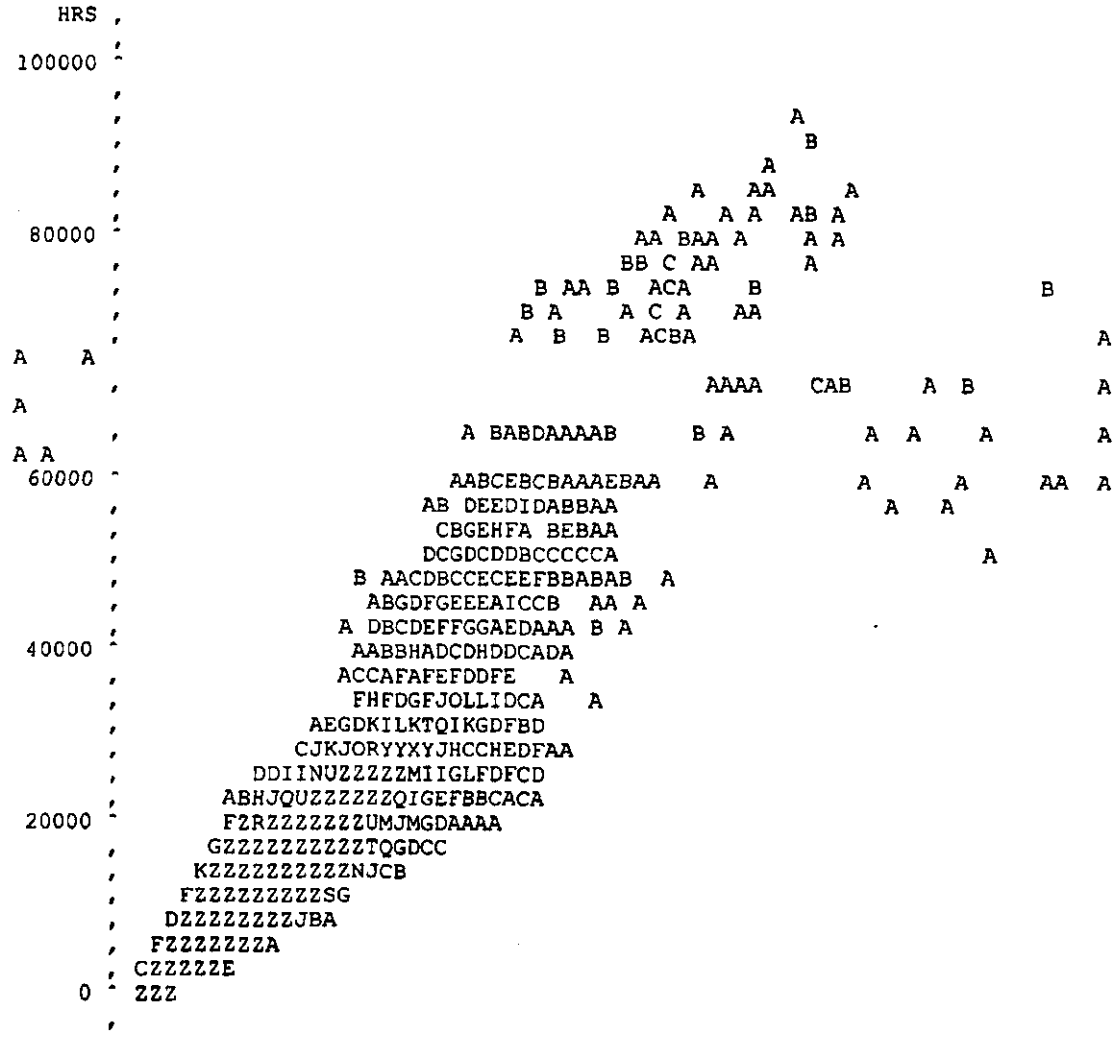
MANUAL LETTER OPERATIONS/ HOURS ON TPH
USING ONLY CONTINUOUS DATA FROM 8801-9613
INCLUDING OFFICES @ LEAST 39 OBS/LAG MODEL
USES 12 AP DUMMIES TO CAPTURE SEASONAL EFFECTS

Plot of HRS*TPH. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 21328 obs hidden.

MANUAL FLAT OPERATIONS/ HOURS ON TPH
USING ONLY CONTINUOUS DATA FROM 8801-9613
INCLUDING OFFICES @ LEAST 39 OBS/LAG MODEL
USES 12 AP DUMMIES TO CAPTURE SEASONAL EFFECTS
Plot of HRS*TPH. Legend: A = 1 obs, B = 2 obs, etc.



NOTE: 20608 obs hidden.

CHAIRMAN GLEIMAN: Mr. Smith, have you had an opportunity to examine the packet of designated written cross examination that was made available earlier today?

THE WITNESS: I have.

CHAIRMAN GLEIMAN: And if those questions were asked of you today, would your answers be the same as those you previously provided in writing?

THE WITNESS: Yes, with the exception of one minor revision.

CHAIRMAN GLEIMAN: And what is that, sir?

THE WITNESS: That is on USPS/OCA-T4-31, in response at (vi), line 2, change "fixed" to "net".

CHAIRMAN GLEIMAN: Has that correction been made in the packages?

THE WITNESS: Yes, it has, Mr. Chairman.

CHAIRMAN GLEIMAN: That being the case, counsel, if you could please provide two copies of the corrected designated written cross examination of the witness to the reporter, I will direct that they be received into evidence and transcribed into the record.

[Designated Written Cross-Examination of J. Edward Smith, OCA-T-4, was received into evidence and transcribed into the record.]

BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, DC 20268-0001

Postal Rate and Fee Changes, 2000 Docket No. R2000-1

DESIGNATION OF WRITTEN CROSS-EXAMINATION
OF OFFICE OF THE CONSUMER ADVOCATE
WITNESS J. EDWARD SMITH
(OCA-T-4)

Party	Interrogatories
Association of American Publishers	AAP/OCA-T4-1-3
United States Postal Service	AAP/OCA-T4-1-3 USPS/OCA-T4-1-51

Respectfully submitted,

Cyril J. Pittack
Acting Secretary

INTERROGATORY RESPONSES OF
OFFICE OF THE CONSUMER ADVOCATE
WITNESS J. EDWARD SMITH (T-4)
DESIGNATED AS WRITTEN CROSS-EXAMINATION

Interrogatory	Designating Parties
AAP/OCA-T4-1	AAP, USPS
AAP/OCA-T4-2	AAP, USPS
AAP/OCA-T4-3	AAP, USPS
USPS/OCA-T4-1	USPS
USPS/OCA-T4-2	USPS
USPS/OCA-T4-3	USPS
USPS/OCA-T4-4	USPS
USPS/OCA-T4-5	USPS
USPS/OCA-T4-6	USPS
USPS/OCA-T4-7	USPS
USPS/OCA-T4-8	USPS
USPS/OCA-T4-9	USPS
USPS/OCA-T4-10	USPS
USPS/OCA-T4-11	USPS
USPS/OCA-T4-12	USPS
USPS/OCA-T4-13	USPS
USPS/OCA-T4-14	USPS
USPS/OCA-T4-15	USPS
USPS/OCA-T4-16	USPS
USPS/OCA-T4-17	USPS
USPS/OCA-T4-18	USPS
USPS/OCA-T4-19	USPS
USPS/OCA-T4-20	USPS
USPS/OCA-T4-21	USPS
USPS/OCA-T4-22	USPS
USPS/OCA-T4-23	USPS
USPS/OCA-T4-24	USPS
USPS/OCA-T4-25	USPS
USPS/OCA-T4-26	USPS
USPS/OCA-T4-27	USPS
USPS/OCA-T4-28	USPS
USPS/OCA-T4-29	USPS
USPS/OCA-T4-30	USPS

USPS/OCA-T4-31	USPS
USPS/OCA-T4-32	USPS
USPS/OCA-T4-33	USPS
USPS/OCA-T4-34	USPS
USPS/OCA-T4-35	USPS
USPS/OCA-T4-36	USPS
USPS/OCA-T4-37	USPS
USPS/OCA-T4-38	USPS
USPS/OCA-T4-39	USPS
USPS/OCA-T4-40	USPS
USPS/OCA-T4-41	USPS
USPS/OCA-T4-42	USPS
USPS/OCA-T4-43	USPS
USPS/OCA-T4-44	USPS
USPS/OCA-T4-45	USPS
USPS/OCA-T4-46	USPS
USPS/OCA-T4-47	USPS
USPS/OCA-T4-48	USPS
USPS/OCA-T4-49	USPS
USPS/OCA-T4-50	USPS
USPS/OCA-T4-51	USPS

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES AAP/OCA-T4-1-3

AAP/OCA-T4-1 On page 40 of your testimony (line 12) you state that "In the *long run*, all of the factors of production are variable." With respect to this statement:

(a) Please confirm that in the long run, the factors of production that are variable at the Postal Service include all wage levels and all work rules that are in effect under the Postal Service's existing contracts with all labor unions whose members are employed by the USPS. Please explain in detail any answer other than a confirmation.

(b) Please confirm that in the long run, the factors of production that are variable at the Postal Service include all transportation contracts between the Postal Service and all outside rail, air and trucking firms that now furnish purchased transportation services to the USPS. Please explain in detail any answer other than a confirmation.

RESPONSE TO AAP/OCA-T4-1. (a) Not confirmed. Labor is a factor of production and would be variable in the long run. Work rules are not a factor of production.

(b) Not confirmed. I have not testified on transportation services and am unable to confirm the statement due to a lack of knowledge on the issue(s).

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES AAP/OCA-T4-1-3

AAP/OCA-T4-2 With respect to the discussion of the economic concept of the long run which is discussed on page 40 of your testimony, please indicate whether you agree or disagree that the "very long run" is a period so long that all of a firm's present contracts will have run out and its present plant and equipment will have been worn out or rendered obsolete and will therefore need replacement. Please identify and explain any area of disagreement with this economic concept.

RESPONSE TO AAP/OCA-T4-2. I disagree. Economics defines the long run and the short run. Neither have any specific reference to time; rather, they define the circumstances under which costs are not fixed. In the case of Postal proceedings, the Postal Service has made references to time periods in the neighborhood of one or several years over which production inputs are not fixed. Accordingly, the long run for segment 3 mail processing costs may be the rate effective time period. Alternatively, such a time period may serve as an approximation of the long run. However, the concept of a "very long run" is not a concept that has been defined in economic theory.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES AAP/OCA-T4-1-3

AAP/OCA-T4-3 Please explain fully, on a step-by-step basis, how you recommend the Postal Service should measure its labor costs that are variable over the long run as that term is used on page 40 of your testimony.

RESPONSE TO AAP/OCA-T4-3. In Appendix F, "Analysis of Postal Service Mail Processing Labor Cost Models," in Appendices to Opinion and Recommended Decision, Volume 2, Docket No. R97-1, May 11, 1998, the Commission cited a number of deficiencies in Dr. Bradley's testimony; many of the deficiencies have carried over to Dr. Bozzo's work. These deficiencies and other problems are the subject of my testimony. My recommendations are to correct the problems, with the additional presentation of the underlying economic theory, database verification and/or improvement, the consideration of appropriate variables, and the choice of an appropriate estimation procedure. By correcting the deficiencies mentioned by the Commission, myself, and other witnesses, as appropriate, the Postal Service would be able to measure labor costs that are variable over the long run. Since the design of a study is a major and controlling part of the research effort, the formation of a working group in order to review and comment on issues on a measured and careful basis subject to thoughtful consideration is important.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-1. Please refer to your testimony at page I, line 9. Please specify each regulatory proceeding, other than Docket No. R97-1, in which you gave testimony pertaining to an econometric analysis of panel data, and provide a copy of the written testimony. If there are no such instances, please so indicate.

RESPONSE TO USPS/OCA-T4-1. With the exception of Docket No. R97-1, I have not provided testimony on the econometric analysis of panel data.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-2. Please refer to your testimony at page 13, lines 34 and footnote 14.

(a) Please define the term "equilibrium point" as you use it in the footnote.
(b) Please define the term "facility size" as you use it in the footnote.

RESPONSE TO USPS/OCA-T4-2. (a) The Commission has implicitly referenced the equilibrium point in Appendix F of the Opinion in Docket No. 97-1. (Appendices to Opinion and Recommended Decision, Volume 2, Appendix F, Docket No. R97-1 at 43). For a more detailed exposition see *Econometric Models, Techniques, and Applications* by Intriligator, Bodkin and Hsiao, at page 278 (Michael D. Intriligator, Ronald G. Bodkin, and Chen Hsiao, *Econometric Models, Techniques, and Applications,* Second Edition, Upper Saddle River, New Jersey, Prentice Hall, 1996):

> The equilibrium of the firm in the long run, when both inputs can be freely varied, is at the tangency of an isocost to an isoquant. Only at such a point is output maximized for a given cost or, equivalently, is cost minimized for a given output. The former follows by moving along any one isocost: if at any one point it crosses an isoquant it is possible to increase output with no additional cost--by moving toward the tangency point. Similarly, moving along any one isoquant, if at any one point it crosses an isocost, it is possible to decrease cost while holding output constant--by moving toward the tangency point. The locus of tangency points is the set of possible equilibrium points for the firm; it is called the expansion path and is characterized by the equality of slopes of isocost and isoquant. From the above results on these slopes, the geometric tangency is in fact equivalent to the algebraic conditions (8.2.7), stating that, for profit maximization, the marginal rate of technical substitution must equal the ratio of wages.
>
> The possible equilibrium points along the expansion path of Figure 8.1 indicate at each such point an output, y, from the isoquant, and a level of cost, C, from the isocost. The set of all possible pairs of output and cost along the expansion path defines the cost curve: C = C(Y) *(8.2.14), in this case the long-run total cost curve, since it represents total cost: C = $w_1x_1 + w_2x_2$ (8.2.15) in the long-run situation in which all factor inputs can be varied freely. A *short-run cost curve* is defined using an alternative

expansion path that reflects whatever factors are fixed in any particular short run. An example would be the expansion path defined by the horizontal line at $\bar{x}_2$, where the second input is fixed at this level and the first input is free to vary.

(b) Facility size is defined in terms of the specific isoquant currently producing product.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-3. Please refer to your testimony at page 15, lines 15-18, where you discuss the "random effects" estimator. Do you mean to say in line 18 that the random-effects model assumes that the facility specific characteristics are stochastic (i.e., random)? If not, please explain.

RESPONSE TO USPS/OCA-T4-3. Yes. My paraphrasing of Dr. Bradley's testimony is based on his statement "Alternatively, one could model the facility-specific effects as random events." (USPS-T-14, Docket No. 97-1, lines 24-25 at 43.)

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-4. Please refer to your testimony at page 28, lines I-2. Did you perform any quantitative analysis of Dr. Bozzo's data, models, or results to determine whether the "underlying investment series" is actually "unrepresentative of current operations"? If so, please describe the methods and results of your analysis in detail.

RESPONSE TO USPS/OCA-T4-4. An analysis of the models or results would not be indicative of whether the data are unrepresentative of current operations. Instead, I base my comments on a review of USPS investment and investment policies rather than on any particular quantitative analysis of Dr. Bozzo's data, models, or results. It is clear that in recent years there has been significantly increased investment in mail processing equipment, and the Postal Service discusses ongoing investment efforts in this case. It appears that the Postal Service has a variety of activities at mail processing plants in various stages of technological sophistication. One obtains the impression that major savings are being obtained, or are about to be obtained, from new technologies and facilities. Accordingly, an analysis that includes data for obsolete facilities may not be representative of costs to be incurred in the future.

This is an example of an issue whose analysis would benefit from input from USPS experts as well as a review of site specific data on a facility-by-facility basis for the MODS operations. A working group cooperatively focused on the resolution of this issue would be appropriate.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-5. Please refer to your testimony at page 28, lines 5-7. Also please refer to Dr. Bozzo's testimony, USPS-T-l5 at pages 78. line 11 to page 79 and Appendix D, page 152.

(a) Please confirm that the referenced sections of Dr. Bozzo's testimony discusses "the appropriate way, if any, to use data from previous years to evaluate the elasticities [volume-variability factors] for the 1998 Base Year" and present the results of evaluating the elasticities using only the FY 1998 observations. If you do not confirm, please state your understanding of the referenced sections.

(b) Did you perform any quantitative analysis of Dr. Bozzo's data, models, or results to determine whether any relevant discontinuities actually exist and/or to quantify their effects? If so, please describe the methods and results of your analysis in detail.

RESPONSE TO USPS/OCA-T4-5. (a) The statement is confirmed, subject to noting that there are a substantial number of problems in the testimony as well as an incorrect model. An interesting issue for the proposed working group to explore would be the impact of 1999 data on the results of a correctly specified model. This would be an appropriate topic for consideration by a working group.

(b) As stated, I found significant problems with Dr. Bozzo's models, and data are not available to correct the problems. Accordingly, any reestimation would be irrelevant at this time. This also would be an appropriate topic for consideration by a working group.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-6. Please refer to your testimony at page 38, lines 6-7. Please also refer to Docket No. R97-1, USPS-T-14 at page 12, and the Commission's Docket No. R97-1 Opinion and Recommended Decision, Vol. 1, at page 81 (paragraph 3039) and page 83 (paragraph 3043).

(a) Please confirm that Dr. Bradley characterized his models as "cost equations" which he (and the Commission) specifically distinguished from "cost functions" as the latter term is normally used in treatments of economic production theory. If you do not confirm, please explain.

(b) Please indicate your understanding of the Commission's reference, at page 83 (cited above), to Dr. Bradley's need to provide a data set sufficient to "specify cost functions or, more precisely, functions describing the Postal Service's derived demand for mail processing labor time."

RESPONSE TO USPS/OCA-T4-6. (a) Confirmed.

(b) Paragraph 3039 concludes that the Bradley approach lacks a firm basis in economic theory. Deficiencies include the use of a cost equation rather than a cost function, the use of accounting period data that are inconsistent with the operating plan, and, implicitly, a criticism of the short run nature of the study.

Paragraph 3043 of the Commission's Opinion criticizes the data set. The Commission indicated that Dr. Bradley did not "include a sufficient set of explanatory variables to properly specify cost functions." The data requirements associated with a translog cost function, a production function, and a labor demand function are well known; a reference source is Chapter 12 of *Chung's Utility and Production Functions.* (Jae Wan Chung, *Utility and Production Functions,* Blackwell, 1994).

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

USPS/OCA-T4-7. Please refer to your testimony at page 38, lines 12-18 and footnote 47.

(a) Do you contend that formal (mathematical) derivation of the labor demand function cannot be performed? Please explain any answer other than an unqualified no.

(b) Is it your understanding that sources in the economic literature provide and/or discuss the derivation, including (but not limited to) the material cited in Dr. Bozzo's response to OCA/USPS-T-15-56(c), to which you refer in footnote 47? Please explain any answer other than an unqualified yes,

RESPONSE TO USPS/OCA-T4-7. (a) No. The testimony would have been enhanced by providing the derivation of the function, along with sufficient discussion of the appropriate variables, a discussion of the properties of the function, a discussion of the implications of various results under various market conditions, and a discussion of the relevant literature.

(b) Yes, and it would have been appropriate to include the information in Dr. Bozzo's testimony. To be specific, by presenting a derivation of the labor demand function as related to a production function or a cost function, the analyst would set the basis for the consideration of appropriate variables, estimating procedures, and functional type (Dr. Bradley presents the information in terms of a cost function; Dr. Bozzo presents the information in terms of a labor demand function). There is substantial confusion.

A relatively succinct presentation of the translog production, cost, and factor demand function may be found in Chapter 12 of *Utility and Production Functions,* (Jae Wan Chung, *Utility and Production Functions,* Blackwell, 1994). The book also presents an overview of selected studies, including country and industry data (pooled,

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-1-7

cross sectional, time series: the associated footnote mentions that a cross-section analysis yields long-run effects, whereas a time-series analysis yields short-run effects), assumptions (linear homogeneity, separability, homotheticity), estimation technique, and results.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-8. Apart from those reported in Table 6 of your testimony, did you perform any regression analyses to attempt to quantitatively validate your criticisms of Dr. Bradley's and Dr. Bozzo's methods and/or results, or for any other reason pertaining to your testimony? If so, please provide detailed descriptions of the purpose(s), method(s) and result(s) of your analyses. If not, why not?

RESPONSE TO USPS/OCA-T4-8. Yes. I ran a number of the TSP programs furnished by Dr. Bozzo, and, as expected, obtained identical results. In some cases, I made minor changes in the programs for purposes of experimenting with the application of TSP. Dr. Bozzo has already furnished the output of his programs, and I have no further results.

The Library reference to my testimony reports on a number of other regressions.

Finally, I performed a variety of SAS runs on Dr. Bradley's data as well as a small number of SAS runs on various other data related to Postal Service hours and mail volumes. I did not view these regressions as worthy of reporting or retention.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-9. Did you perform any quantitative analysis (including, but not limited to, regression analysis) of the data provided in USPS-LR-I-107 to attempt to quantitatively validate your criticisms of Dr. Bradley's and Dr. Bozzo's methods and/or results, or for any other reason pertaining to your testimony? If so, please provide detailed descriptions of the purpose(s), method(s) and result(s) of your analyses. If not, why not?

RESPONSE TO USPS/OCA-T4-9. I performed a review of the regression equations, but did not perform a quantitative analysis. Quantitative analysis is inapplicable in resolving many of my criticisms:

The database was not adequately examined and verified for accuracy. The MODS database has been shown to be unreliable for these purposes. Additional field checking of the data appears to be necessary. This would be resolved in a data analysis effort with substantial field contact.

Investment and capital data based on the historical data series may be unrepresentative of future operations.

The continued use of the manual ratio is undesirable.

The QICAP variable is defective for application to the analysis.

Capacity utilization may be a cost driver; it is not considered.

The analysis is short term.

Additional explanation and improvement of the underlying theory is needed, particularly as related to operational objectives (i.e., cost minimization, choice of functional forms, homotheticity).

The use of a fixed effects approach is inappropriate.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

There are concerns over the appropriateness of the TPF variable; use of FHP may be more appropriate, for TPF is itself a function of the sorting scheme.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-10.

a. Do you contend that none of the criticisms of Dr. Bradley's and Dr. Bozzo's methods and/or results can be resolved with the data provided in the Docket No. R97-1 and Docket No. R2000-1 proceedings?
b. If your response to part (a) is affirmative, please enumerate each criticism and provide a detailed explanation of why you believe resolution of the criticism is impossible. If you respond in the affirmative because you believe additional data are required, please state and justify theoretically your beliefs regarding the nature of the additional data that may be needed.
c. If your response to part (a) is negative, in whole or in part, please enumerate each criticism you believe could potentially be resolved. In each case, please state and justify theoretically your beliefs regarding the methods that might resolve the issue.

RESPONSE TO USPS/OCA-T4-10. (a) Yes, in terms of my criticisms. I am still studying the deficiencies in the studies raised by other witnesses and do not feel sufficiently confident in my understanding of their testimony to answer questions related to their testimony. Other witnesses may best respond to you about their testimony.

(b) Due to the remarkably broad nature of the question, I may inadvertently omit one or more criticisms as related to the data. Accordingly, it may be necessary to provide supplemental criticisms subsequently. Many of the criticisms below do not directly relate to the data, but they do touch on aspects of the data; accordingly, for purposes of comprehensiveness they are supplied:

The database was not adequately examined and verified for accuracy.

The MODS database has been shown to be unreliable for the purposes used. Additional field checking of the data appears to be necessary.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

Investment and capital data based on the historical series may be unrepresentative of future operations.

The continued use of the manual ratio is undesirable.

The QICAP variable is defective for application to the analysis.

Capacity utilization is potentially a cost drive but is not considered.

The analysis is short term.

Additional explanation and improvement of the underlying theory is needed, particularly as related to operational objectives (i.e., cost minimization, choice of functional forms, homotheticity).

The use of a fixed effects approach is inappropriately applied. This is not strictly a data requirement but is provided only for purposes of completeness.

There are concerns over the appropriateness of the TPF variable; a FHP variable coupled with a facility level rather than activity level approach may be more appropriate.

You will find explanations of the above issues in my testimony. I particularly call your attention to questions about the accuracy of the MODS data base, my concern that investment data are not available at the activity level, and concern over the consideration of potentially omitted variables such as capacity utilization. Since the theoretical basis of the study has not been clearly presented, it is difficult to verify specific data items that may or may not be required.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

It should be noted, however, that my testimony has focused on the study presented. Although I have suggested possible improvements, the time frame of an interrogatory response is inadequate for full consideration of data problems and needs. Accordingly, I have advocated the establishment of a working group, which could give careful and considered review to the proper conduct of a study.

(c) Theoretical issues could be addressed without the gathering of additional data. I believe that the best approach would be to convene a working group to review the material in the less adversarial nature of a meeting. I note that the formal interrogatory process is not well suited to the development of the modeling process, and informal data conferences with lawyers objecting to various questions are little better.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-11. On page 5 (lines 4-6) of your testimony you define volume variability as "the percentage change in cost that results from a percentage change in volume, holding delivery points and other non-volume factors constant."

a. Would you therefore disagree with the statement: "growth in delivery points must be considered a part of the growth in volume"? If you would not, please reconcile your answer with the quoted passage from your testimony.
b. Please explain your understanding of how a statistical estimation technique such as regression "holds constant" a non-volume factor such as delivery points.

RESPONSE TO USPS/OCA-T4-11. (a) There could be a growth in volume with no growth in delivery points. Conversely, conceivably, there could be a growth in delivery points without a change in volume.

(b) In computing the volume variability, Dr. Bozzo has estimated the multivariate econometric model of hours of labor as a function of TPF and other variables; only the estimator associated with the TPF variable is used in computing the variability. Accordingly, in order to be precise, the statement should be "the percentage change in cost that results from a percentage change in volume".

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-12. Please refer to your testimony at page 47, lines 3-12.

a. Please confirm that the passage of Dr. Bozzo's testimony you quote at the cited location refers to "cost-pool-level production (or cost) functions." If you do not confirm, please state your understanding of the quoted passage.
b. Is it your testimony that the "investment programs designed to reduce [mail processing] costs" to which you refer would reduce costs in every cost pool? Please explain your answer.
c. Can programs to shift mail processing from labor-intensive (manual) cost pools to capital-intensive (automation) cost pools alter the facility-wide (or systemwide) capital-labor ratios without materially altering the capital-labor ratios at the cost pool level? Provide a detailed justification of any negative answer.

RESPONSE TO USPS/OCA-T4-12. (a) The statement quoted is from Dr. Bozzo's testimony and is used in the same context.

(b) A cost reducing capital investment for a specific activity at a facility would be expected to reduce operating costs. To the degree that activities are part of a network and depend on each other, the investment may have an impact on the operating costs of other activities. It may also be appropriate to model the activities as a joint production, cost, or labor demand function (depending on the function as defined by the analyst).

(c) It would appear that this is a question the Postal Service should be addressing and explaining in detail. Dr. Bozzo did not present detailed data or analysis on this issue. However, based on the very limited information that I have available, I would assume that the answer is yes.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-13. Please refer to your testimony at page 47, line 16, to page 51, line 13. Also refer to Dr. Bozzo's response to OCA/USPS-T-15-58, Tr. 15/6362-6364.

a. Do you disagree with Dr. Bozzo's statement, provided in response to OCA/USPS-T-15-58(a) (Tr. 15/6362-63), that "my facility-level capital variable (QICAP) does not make use of the Postal Service's Total Factor Productivity results (i.e., the TFP index). Rather, it makes use of methods developed to measure capital input for the TFP analysis. That is, the relationship between my analysis and the Postal Service's TFP analysis is that they share common methods to develop data on economic input?" If so, please state the basis for your disagreement.
b. Does Dr. Bozzo's statement, quoted in part (a) of this interrogatory, explain the nature of the "references to Total Factor Productivity" you mention at page 48, line 2 of your testimony? Please explain any negative answer.
c. Do you have any evidence that the Postal Service's behavior is described by "output maximization"? If so, please provide all such evidence.
d. Do you believe that the institutional environments in which the Postal Service operates and the Soviet manufacturing industries operated are comparable? If so, please provide all evidence that supports your belief.

RESPONSE TO USPS/OCA-T4-13. (a) This is not strictly a yes/no question. The issues that are open to consideration are whether the TFP index is incorrectly computed (the article and information referenced by Dr. Bozzo led to this conclusion), and whether Dr. Bozzo's work is incorrect (by maintaining that he uses the same methods, Dr. Bozzo sets the basis for the conclusion that the results are incorrect). Although I did not state that he used the TFP index, it appears that the development of the index may involve the use of prices that are incorrect; he states that he used a common method. If he used a common method, it would be desirable for him to clarify whether his method makes use of incorrect prices. Otherwise, it is not a common method.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

(b) This also can not be answered with a "yes" or "no". As can be gathered from my previous statement, I don't believe that Dr. Bozzo's statement adequately addresses the issues.

(c) Yes. The need to increase volume of mail is a very familiar refrain in communications from the Postal Service. For example, in the Postal Service's May *Mid-Atlantic Area Update*, Vice President Henry A. Pankey references the growth of mail volume and revenue growth as one of the three pillars needed to support the Gateway to America's households and businesses. He references a Postal Forum speech by the Postmaster General.

(d) Yes. Although there are significant social and institutional differences between American and Russian governmental philosophies ranging back in historical precedent (*e.g.*, no postmaster has been liquidated for failure to meet plan), in fact, there is significant evidence to suggest that the Postal Service in many ways operates in a manner similar to a state controlled business in a non market economy: these similarities include output maximization, central planning, investment actions that may be sub optimal, and concern over efficiency.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-14. Please refer to your testimony at page 24, lines I-10. On page 24 (lines 9-10) of your testimony you state that "[o]ne response [to an interrogatory, at Tr. 15/6387-81 discussed data errors due to commingling of manual and SPBS parcels." At lines 6-7, you state that "[field level data verification appears to be required to provide a sound basis for the analysis."

a. Do you disagree with Dr. Bozzo's statement at Tr. 15/6388 that "the manual parcels observations [from the site in question] do not enter the manual parcel regression sample"? If so, please state the basis for your disagreement.
b. Is it your opinion that the manual parcels data from the site in question was actually erroneous? If not, please state the basis for your belief.
c. Assuming the data could not be reconstructed, what would you propose doing with the manual parcels data for that site? Justify your answer in detail.
d. Do you disagree with Dr. Bozzo's statement at Tr. 15/6387 that "[i]n contrast to the other MODS operations I studied, manual parcels and Priority volumes must be manually logged, so the volume data collection process is considerably more labor intensive than for operations in which volume data are transmitted from equipment or scales via electronic interfaces." If so, please state the basis for your belief.

RESPONSE TO USPS/OCA-T4-14. (a) No.

(b) To the degree that data from two activities are commingled, as indicated by Dr. Bozzo, the data are unsuitable for analysis; whether you term the data erroneous, unsuitable, misleading, inaccurate, or any of a number of other terms, the use of such data would be inappropriate.

(c) The absence of data can be a problem. Potentially, one could obtain a biased estimate due to the unavailability of data. A good data collection procedure would begin with careful data collection, appropriate follow up, and, subsequently, the statistical analysis of the data set. Assuming that the data could not be reconstructed, one would need to determine whether the resulting data set was representative of the population of data.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

(d) I do not disagree; in fact, the statement illustrates the importance of implementing the data collection procedures that I advocate.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-15. Please refer to your testimony at page 68, lines 1-2. With reference to the analysis you present on the previous page, you state that "A modeling approach consistent with the data would be the 'between' model or the pooled model." Did you perform any formal specification test(s) to validate your statement? If so, provide a detailed description of the test method(s) and results. If not, what is the basis for your statement?

RESPONSE TO USPS/OCA-T4-15. I did not perform any formal specification tests to validate the statement. There has been extensive analysis presented comparing the fixed effects, pooled, and cross sectional approaches as presented in the Postal Service sponsored testimony of witness Bradley in the previous case and witness Bozzo in this case. The Postal Service analysis of the regression results has found that the fixed effects approach is preferable in analyzing the cases presented. However, I maintain that the modeling effort as presented by Dr. Bozzo, and previously Dr. Bradley, is incorrect; accordingly, the tests as presented are meaningless.

I have not presented an alternative model of mail processing costs. I have, instead, concluded that a working group is the appropriate deliberative and collaborative forum for the development of the model which could then be presented before the Commission. It is highly unlikely that a model acceptable to all parties would be developed in the four month time frame of a rate case,

particularly in view of the massive efforts which the Postal Service has already devoted to the work and the projected efforts to conclude the effort.

At this time, the "between model" presented by Dr. Bozzo is the "least bad" of the models presented by the Postal Service. Cross section estimates relate to the long run version of many parameters, rather than the short run version relevant for time series studies. In studying long-run elasticities one may use cross-section data, while for purposes of short-run forecasting time-series data may be appropriate.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

USPS/OCA-T4-16. Please refer to your testimony at page 66, lines 24-25, where you state "Dr. Bozzo apparently believes that the multivariate nature of the modeling process makes the bivariate graphs irrelevant."

a. Do you believe that appropriate econometric models for measuring mail processing volume-variable costs would be multivariate in nature?
b. If your response to part (a) is negative, reconcile the inconsistency between your response to part (a) and your claim on page 36 of your testimony that there is at least one variable you believe to be important omitted from Dr. Bozzo's study.
c. Do you disagree with Dr. Bozzo's testimony on the shortcomings of visual analysis, presented at page 60, line 21, to page 61, line 12? If so, please state each point of disagreement, discuss in detail the *nature of your disagreement, and provide all evidence* that supports your position.

RESPONSE TO USPS/OCA-T4-16. (a) I don't know.

(b) Two important variables for the analysis of volume variability appear to be TPH and hours. On a bivariate basis they seem to be closely associated. Applying the concept from William of Ockham, *Pluralitas non est ponenda sine necessitate* (this translates as "entities should not be multiplied unnecessarily." Put differently, "keep it simple"), also known as Ockham's Razor, one would look for the simplest explanation, and a simple explanation is that there is a very high degree of relationship between the two variables: it is visually compelling.

As the modeling in the case has grown more complicated, the estimated variabilities have declined--but the hours/TPH data still vary together closely. Accordingly, I believe that additional analysis would be appropriate, which is why I advocate the working group.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-8-16

(c) There appear to be two major points in Dr. Bozzo's testimony:

1. It is impossible to determine whether any two points represent observations of the same site in different periods, the same period at different sites, or different sites and periods. I agree.

2. Visually fitting a line or curve to a plot is not an adequate substitute for numerical analysis and formal specification tests. I neither agree nor disagree with the statement. Instead, I offer the following observation. The data suggest a strong relationship between TPH and hours; Ockham's Razor suggests that the simplest explanation is preferred. I conclude that there is a strong relationship between TPH and costs as presented in the data.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-17-19

OCA/USPS-T4-17. Please refer to your testimony at page 23, lines 16-17, where you state "The differences between Dr. Bradley's data set and the data set used in the current study are actually quite minor."

(a) Does this statement (i.e., the "data set used in the current study") refer only to the portion of Dr. Bozzo's data set obtained from MODS and provided in USPS-LR-I-107.

(b) If your answer to part (a) is negative, in whole or in part, please specify your understanding of which variables in the data set provided in USPS-LR-I-107 were not present in Dr. Bradley's data set.

RESPONSE TO USPS/OCA-T4-17. (a) Yes. However, please note that I believe that QICAP as currently presented is theoretically flawed. In addition, QICAP as now presented is not at the activity level; this is also a major deficiency. I also believe that additional variables should have been considered.

(b) Not applicable.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-17-19

OCA/USPS-T4-18. Please refer to your testimony at page 23, lines 17-19. You state that "[q]uarterly data are used in the current study in lieu of four week accounting period data in order to smooth out inaccuracies."

(a) Is Dr. Bozzo's response to MPA/USPS-T15-7 (Tr. 15/6273-6274) the basis for the quoted statement? If not, please specify the basis for your statement.

(b) Does your quoted statement completely represent Dr. Bozzo's stated reasons for choosing the quarterly observation frequency? Please explain any affirmative answer.

(c) Other things equal, is a method that "smooth[s] out inaccuracies" preferable to one that does not? Please explain any negative answer.

RESPONSE TO USPS/OCA-T4-18. (a) Yes.

(b) As indicated by Dr. Bozzo, in addition to mitigating data errors, quarterly data permits the use of other quarterly data sources. Also, the use of quarterly data permits longer-term labor adjustment processes to be specified with fewer variables. This is only a brief summary of the interrogatory.

(c) It would be preferable to use accurate data. In smoothing out inaccuracies, one would need to analyze how the inaccuracies are smoothed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-17-19

OCA/USPS-T4-19. Please refer to your testimony at page 23, line 19, where you state "the rejection criteria are relaxed." What, specifically, are the "rejection criteria" to which the statement refers? As part of your answer, please provide citations to any portions of Dr. Bozzo's testimony upon which the statement is based.

RESPONSE TO USPS/OCA-T4-19. Please see page 21, lines 15 through 22 and Section VI.E of Dr. Bozzo's testimony. Dr. Bozzo eliminated less data.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

USPS/OCA-T4-20. Please refer to your testimony, OCA-T-4, at page 18, lines 14-16. You state that "[t]he expansion path is the hyperplane that should be measured, not the short-run hours/TPF relationship." Consider an economic (variable) cost function c = f(y,w,x*,z) and the associated derived labor demand function l = h(y,w,x*,z). In this notation, c denotes real cost, l real labor input, y real output ("volume"), w the price(s) of variable factor(s) over the desired length of run, x* the quantities of factors that are quasi-fixed (if any), and z denotes other variables determining cost and hence labor demand, and f and h are functions with appropriate mathematical properties. Please indicate how you believe the "expansion path" to which you refer relates to the cost and/or labor demand functions as defined above. Please relate your answer to the standard treatment of economic cost theory as presented in, e.g., Robert G. Chambers' *Applied Production Analysis*. If you cannot specify the relationship between the "expansion path" and the cost and/or labor demand functions defined above, please so indicate.

RESPONSE TO USPS/OCA-T4-20. As indicated by C.E. Ferguson, *Microeconomic Theory,* Irwin, 1969, Revised Edition, page 174, "...the expansion path is crucial in determining the long-run cost of production." In *Econometric Models, Techniques, and Applications* (by Michael D. Intriligator, Ronald G. Bodkin, and Cheng Hsiao, Second Edition, Prentice Hall, 1996) the authors show the expansion path of the firm on page 277. They show that the set of all possible pairs of output and cost along the expansion path define the cost curve, page 278. They then show that given the profit-maximizing output, the choice of inputs is given at that point where the corresponding isoquant intersects the relevant expansion path. In general, one can obtain a system of factor demand functions, as presented on page 280.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

USPS/OCA-T4-21. Please refer to your testimony, OCA-T-4, at page 19. lines 3-4, where you state that "it is not clear whether capital is an exogenous or an endogenous variable and whether some type of reduced form simultaneous equations system is needed." On the same page, at lines 7-8, you state that "capital is treated as exogenous when it may in fact be endogenous."

a. Please confirm that, in response to oral examination by counsel for OCA, Dr. Bozzo stated he considered capital to be "predetermined" for the purposes of his analysis (see Tr. 15/6414, line 23; Tr. 15/6415, lines 3-7).
b. Please confirm that in econometrics, "predetermined" variables are variables that are "not exogenous, but, as regards the current values of the endogenous variables, may be regarded as having already been determined" (see William H. Greene, *Econometric Analysis*, Second Edition, page 581). If you do not confirm, please state your understanding of the econometric content of the term "predetermined" and provide references to appropriate sources in the econometrics literature to support your position.
c. Please confirm that the "relevant distinction" that determines whether a simultaneous equations statistical model is needed is "between jointly dependent [endogenous] variables and predetermined variables," including exogenous variables (see George G. Judge, et. al., *The Theory and Practice of Econometrics*, Second Edition, Wiley, 1985, at page 565). If you do not confirm, please state fully your understanding, and provide references to appropriate sources in the econometrics literature to support your position.
d. Is it your understanding that there is a time lag between the Postal Service's investment decisions and the availability of the related equipment for Postal Service operations? Please explain fully any answer other than an unqualified yes, and provide all document(s) and studies that support your position.

RESPONSE TO USPS/OCA-T4-21. (a) Confirmed

(b) Assuming that the quote is repeated in the third edition of Dr. Greene's book on page 711, I will confirm. Lagged endogenous variables are often called "predetermined" variables.

(c) I find no such reference in the aforementioned book on page 565. Furthermore, I do not believe that capital should be modeled as predetermined in the long run.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

(d) Whether or not there is a time lag between investment decisions and the availability of the equipment is irrelevant; the relevant question would be whether the capital used in a time period is related to the activity level. For example, one might forecast correctly two years in advance that a certain level of capital is needed for a certain level of mail processing. but with concurrent acquisition of capital for current increased mail processing load. Based on information furnished by the Postal Service, it appears that the current level of capital is related to the current level of activity, though not necessarily on a 100 percent basis. I have no documents, studies, or analyses not in the public domain; my statements are based on the information available before the Commission.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

USPS/OCA-T4-22. Please refer to your testimony, OCA-T-4, at page 19, fines 6-7. You reference the inclusion of "variables assumed non-volume variable that are actually volume-variable" in Dr. Bozzo's analysis, specifically the manual ratio and capital, as an indication that his analysis is "fatally flawed."

a. Is it your testimony that, if the manual ratio and/or capital are volume-variable (to any degree), the effects of those variables on mail processing labor costs cannot in principle be incorporated into calculations of the corresponding volume-variability factors, and instead the entire econometric analysis must be discarded as "fatally flawed"?
b. Please confirm that Dr. Bozzo presents estimates of the elasticities of workhours with respect to capital and the manual ratio for the cost pools covered by his study in USPS-T-15 at pages 119-120. If you do not confirm, please explain.
c. Please confirm that Dr. Bozzo presents a derivation of the "manual ratio effect," i.e., the appropriate calculations for treating the manual ratio as volume-variable, in Appendix C of USPS-T-15. If you do not confirm, please explain.

RESPONSE TO USPS/OCA-T4-22. (a) The Commission concluded that Dr. Bradley's manual ratio variable was volume variable; see Docket No. R97-1, "Appendices to Opinion and Recommended Decision Volume 2," Appendix F, at 38. Capital is required for the processing of mail and, accordingly, is in my opinion also volume variable. This could be addressed by treating capital as an endogenous variable, not predetermined.

(b) Confirmed.

(c) Confirmed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

USPS/OCA-T4-23. Please refer to your testimony, OCA-T-4, at page 20, lines 9-12.

a. In the section of your testimony cited above, you state, "The current estimators appear to be tentative." What do you mean by the term "tentative" in reference to econometric estimators? Please provide appropriate references to the econometric literature to support your answer.
b. Please explain your use of the term "appear" in the statement quoted in part (a)--i.e., does your usage of the term "appear" signify that you have not conducted an analysis that would determine whether the current estimators actually are "tentative"?
c. In the section of your testimony cited above, you state that "the proposed variabilities have actually changed over the short course of several years, apparently due to changes in data scrubbing and methodological changes." If the original data "scrubs" and methodology were flawed, and those flaws were remedied, would you expect the variabilities to change as a result of the remedy? Please explain why or why not.

RESPONSE TO USPS/OCA-T4-23. (a) The word "tentative" is more appropriately defined in the dictionary, not the econometric literature; the meaning is "offered, undertaken, or arrived at as a first step; provisional." For example, I have testified to the deficiencies of the study; the study is at best a "first step." In addition, the Postal Service studies have revised variabilities with each offering. The variabilities computed by Dr. Bozzo statistically differ from those computed by Dr. Bradley in some cases; and the confidence intervals for some variables vary by over 15 percent which could have, in some cases, an impact of over $50 million per activity on attributable costs.

(b) Appear means "to be taken as." I have presented testimony on the analysis and have also estimated confidence intervals for the variabilities presented.

(c) Any answer is speculative. However, I would expect very minimal change in the variabilities on a longer-run basis, and possibly greater change in the variabilities on a short-run basis, assuming that the study were correctly performed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

USPS/OCA-T4-24. Please refer to your testimony, OCA-T-4, at page 20, lines 2-3. You state, "Possibly another five person years of effort would be required to complete the work." Please indicate the scope of "the work" as you use the term in the quoted statement.

RESPONSE TO USPS/OCA-T4-24. "The work" would consist of a study presenting at least the variabilities developed by Dr. Bradley, with appropriate consideration of variables, econometric estimation, and economic theory. Dr. Bozzo in OCA/USPS-T15-20 and OCA/USPS-T15-62 presents time estimates for the various study efforts. One would expect that the required time estimates would be person year levels of effort, not calendar time.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

USPS/OCA-T4-25. Please refer to your testimony, OCA-T-4, at page 64, lines 10-11. You state that "based on Mr. Degen's testimony, [the cross sectional approach] appears to be superior to either the fixed effects or pooled models."

a. Please confirm that Mr. Degen does not claim that the cross sectional approach is superior to the fixed effects or pooled models. If you do not confirm, please provide citations to statements in USPS-T-16 that support your response.
b. If you confirm in response to part (a), please confirm that the conclusion that the cross sectional approach is superior is your testimony, not Mr. Degen's. If you do not confirm, please explain.

RESPONSE TO USPS/OCA-T4-25. (a) Confirmed. However, although Mr. Degen does not specifically make that claim, that conclusion is reached based on a reading of his testimony. Please see my testimony in this docket (OCA-T-4) page 58, lines 2 through 5 and footnote 85.

(b) It is my testimony that in this case the cross sectional approach is superior; this conclusion is based not only on information contained in Mr. Degen's testimony but on various sources in the literature. For example, one can find that "cross-section estimates relate to the long-run version of many parameters" in *A Guide to Econometrics*, Fourth Edition, Peter Kennedy, MIT Press, 1998. Another statement focusing on the econometric estimation of segment 3 costs indicates that I am not alone in my conclusion that the cross sectional approach is superior. See Appendix F, "Appendices to Opinion and Recommended Decision," Volume 2, Docket No. R97-1 at 13, "Both witness Neels and witness Smith have observed that, because of this relatively long production period, the cross sectional dimension of the empirical relationship between costs and volume is more important for determining the true relationship between costs and volumes." Moreover, the Commission concluded,

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-20-25

"Consequently, an estimation procedure which primarily relies on the cross-sectional dimension of the panel dataset is preferred to one that relies on differences over time within the same facility, such as the fixed-effect estimator." Id. at 14.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

USPS/OCA-T4-26. Please refer to your testimony, OCA-T-4, at page 64, lines 15-16, where you state that "cross sectional data are assumed to show a longer-run equilibrium."

a. By "are assumed," do you mean assumed by you? Please explain. If you claim that your statement is a point of econometric theory, please provide detailed citation(s) to relevant sources (e.g., Greene's Econometric Analysis, and/or other recent econometrics textbooks) that support your statement.
b. Is it your testimony that the Postal Service's mail processing plants and/or operations located in the plants operate in a state of long-run equilibrium?
c. If your response to part (b) is affirmative, in whole or in part, please provide all data, analysis, and/or studies that support your belief. If there are none, please so indicate.

RESPONSE TO USPS/OCA-T4-26. (a) Please see USPS/OCA-T4-25(b).

(b) I believe that one should attempt to estimate the long run equilibrium costs. I do not believe that all of the plants and operations operate in a state of long-run equilibrium. This is an issue that could be examined by a working group focused on an acceptable way of estimating segment 3 costs.

(c) Not Applicable.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

USPS/OCA-T4-27. Please refer to your testimony at page 64, lines 9-10. You state, in describing the "between" model, that "a regression analysis is then performed on the sites."

a. Please confirm that by "performed on the sites," you mean, more specifically, performed using the site means of the data. If you do not confirm, please indicate the correct interpretation of the quoted statement
b. Please confirm that the pooled, "between," and fixed-effects estimators employ the same underlying data-i.e., the data that are averaged for use in the "between" estimator are the same data that are employed in the pooled and fixed-effects estimators. If you do not confirm, please explain your answer, and provide references to appropriate sources in the econometrics literature to support your position.

RESPONSE TO USPS/OCA-T4-27. (a) Confirmed.

(b) Confirmed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

USPS/OCA-T4-28. Please refer to your testimony, OCA-T-4, at page 63, lines13-16. You state, "One could allow for the treatment of the data on a pooled basis or cross sectional basis... Such a modeling approach would be consistent with the data..."

a. Is it your testimony that Dr. Bozzo did not "allow for the treatment of the data on a pooled basis or cross sectional basis"? Please explain any answer that is affirmative, in whole or in part.
b. Is it your understanding that the question of whether or not the pooled or "between" estimation methods are "consistent with the data" can be answered with a statistical specification test (or tests)? Please explain any answer other than is anything other than an unqualified "yes," and provide references to appropriate sources in the econometrics literature to support your position.

RESPONSE TO USPS/OCA-T4-28. (a) Yes. He used the fixed effects method and rejected the pooled and cross sectional approaches.

(b) No. Prior to performing the statistical estimation it is necessary to hypothesize a modeling approach, including the clear definition of the underlying economic theory and its applicability, development of appropriate data bases, and choice of estimation approach that will estimate the model. If the cross sectional, pooled, and/or fixed effects models were all theoretically acceptable, then one could perform statistical tests. Dr. Bozzo did, in fact, perform such analysis, but the fixed effects model is based on unrealistic assumptions.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

USPS/OCA-T4-29. Please consider a piece of economic intuition that can be framed as the null hypothesis of an appropriate statistical specification test. Assume that when the test is performed, the null hypothesis is rejected at a confidence level of C percent (or, equivalently, a significance level of 100-C percent).

a. Please confirm that confidence levels of C=90 percent or C=95 percent are widely accepted in econometric practice as minimum confidence levels for rejecting the null hypothesis of a statistical test. If you do not confirm, please explain fully, and provide references to appropriate sources in the econometrics literature to support your position.
b. Please confirm that the standard interpretation of the hypothetical test result described above is that the null hypothesis is likely incorrect, with the probability of a "Type I" error (i.e., rejecting the null hypothesis even though it is correct) given by 100-C percent.

RESPONSE TO USPS/OCA-T4-29. (a) I would generally expect to find the aforementioned confidence levels and/or a 99% confidence level.

(b) Confirmed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

USPS/OCA-T4-30. Please refer to your testimony at page 63, line 22, to page 64, line 2. Is your statement, that "[t]he results [of appropriate econometric techniques and variables] could be 100 percent volume variable, or some other number greater than (or less than) 100 percent volume variable," based on the economic result that findings of economies (or diseconomies) of scale, size, density, etc., are theoretically possible? If not, please explain in detail the basis for your statement.

RESPONSE TO USPS/OCA-T4-30. Yes.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

USPSIOCA-T4-31. Please refer to your testimony at page 32, line 15 (beginning with "He maintains..."), to page 33, line 6. You provide a number of paraphrases of statements you attribute to Dr. Bozzo.

a. Please provide a detailed citation for each statement you attribute to Dr. Bozzo.
b. For each statement you attribute to Dr. Bozzo in the cited section of your testimony, please indicate whether you agree or disagree, or if you have no opinion with respect to the statement. In each case, if you disagree, please explain fully the basis for your disagreement.

RESPONSE TO USPS/OCA-T4-31. (a) I shall delineate each statement and supply a source in the testimony:

(i) Dr. Bozzo essentially maintains that the QICAP variable in its current state is the best estimate of capital usage available. This is inferred from his testimony insofar as a witness would not logically proffer a second best estimate if a better estimate were available. In addition, Dr. Bozzo indicates that his methodology is based on and consistent with the methodology presented by Christensen & Associates, who in their 1992 briefing package, "TFP Presentation to Budgeting Group", extol their approach. The briefing package and extensive documentation are available in USPS-LR-H-272. It should be noted, however, that nowhere in his testimony does Dr. Bozzo reference the variable QICAP, nor does he indicate that the QICAP term is the same term as used in his regression equations. The term is used in USPS-LR-I-107.

(ii) Dr. Bozzo maintains that it is not possible to classify all equipment at a site by cost pool. The appropriate interrogatories are OCA/USPS-T15-48 (c), (d), and (e); OCA/USPS-T15-50 (b); and UPS/USPS-T15-24.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-26-31

(iii) According to Dr. Bozzo, the resulting cost pool level capital measures which would result from segmenting available data by activity cost pool would not represent the cost pools of capital *per se*, but rather, they would represent the portion of the cost pools capital that could be associated with the cost pool using the Property Code Number (PCN). The appropriate interrogatories are UPS/USPS-T15-24 and OCA/USPS-T15-64.

(iv) Dr. Bozzo further notes that data on facility space, which he alleges to be an important non-equipment component of a hypothetical cost pool capital index, are not available by cost pool. See OCA/USPS-T15-50 and UPS/USPS-T15-24.

(v) Dr. Bozzo further maintains that it is not obvious that a cost-pool-level capital measure would be the sole--or even the primary--economically relevant measure of capital. See UPS/USPS-T15-24.

(vi) Dr. Bozzo has indicated that, in his view, the effect of including the facility capital index is to capture the ~~fixed~~ net effect on labor demand in a given cost pool of the capital services employed in that cost pool as well as the capital services employed in other pools. See UPS/USPS-T15-24.

(b) The following comments reference the previously numbered statements.

(i) I agree that Dr. Bozzo believes that the QICAP variable is the best estimate of capital usage.

(ii) I disagree. Classification of equipment by cost pool is a standard procedure. Since some classification may appear to be arbitrary, it would be necessary to determine whether such a classification yields the best

answer. However, a correctly performed analysis might not require the division of jointly shared equipment into specific cost pools.

(iii) I agree and see this as a study deficiency.

(iv) I agree that the data are not currently available.

(v) I agree that the analysis is not obvious; in fact, this may be a reason to consider joint production aspects of mail processing rather than focusing on mail processing as a single activity

(vi) I believe that he has related capital to labor demand, but I do not believe the analysis is correct.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-32-35

USPS/OCA-T4-32. Please refer to your response to USPS/OCA-T4-5(b). Your response does not appear to indicate whether you performed the specified quantitative analysis, as requested in the interrogatory. Please confirm that you did not "perform any quantitative analysis of Dr. Bozzo's data, models, or results to determine whether any relevant discontinuities actually exist and/or to quantify their effects." If you do not confirm, please explain.

RESPONSE TO USPS/OCA-T4-32. Confirmed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-32-35

USPS/OCA-T4-33. Please refer to your response to OCA/USPS-T4-11(a). Your response does not appear to indicate your agreement or disagreement with the quoted statement in the interrogatory, as requested. However, in the response you state, " . . .conceivably, there could be a growth in delivery points without a change in volume." Does this statement imply that you disagree, at least in part, with the statement: "growth in delivery points must be considered part of the growth in volume"? If not, please explain fully.

RESPONSE TO USPS/OCA-T4-33. I neither agree nor disagree with the statement that growth in delivery points must be considered part of the growth in volume. It depends upon the assumptions. Please also see the revision (erratum) to page 5 of my testimony filed today which removes from my definition of volume variability the condition that delivery points and other non-volume factors are held constant.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-32-35

USPS/OCA-T4-34. Please refer to your response to OCA/USPS-T4-11(b).

a. Please provide a mathematical formula to clarify your statement that "only the estimator associated with the TPF variable is used in computing the variability." Please relate any mathematical notation you use to that of the estimating equations reported by Dr. Bozzo at pages 117-118 of USPS-T-15.
b. In the last sentence of your response, you appear to modify the statement quoted from page 5, lines 4-6, of OCA-T-4. Please explain whether this is a correct interpretation. If it is, why does the original statement quoted from page 5, lines 4-6, of OCA-T-4 require modification? If not, please provide the correct interpretation of the last sentence of your response to USPS/OCA-T4- 11(b).

RESPONSE TO USPS/OCA-T4-34. (a) On further review, it is apparent that Dr. Bozzo has used more than the estimator associated with the TPF variable in computing variability. The appropriate annotation is found in footnote 36 at 76 in Dr. Bozzo's testimony. I believe it was Dr. Bradley who used only the estimator associated with the TPF variable in computing variability. In any event, the underlying premise of OCA/USPS-T4-11(b) is moot inasmuch as I have today revised page 5 of my testimony.

(b) Yes. See the revision (erratum) to page 5 of my testimony filed today. This revision is necessary to remove a statement in my direct testimony that conditioned the definition of volume variability upon holding delivery points and other non-volume variables constant. The revision of the definition has no impact upon the conclusions reached in my testimony.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-32-35

USPS/OCA-T4-35. Please refer to your response to USPS/OCA-T4-14(b). Please provide a detailed citation to support your statement that Dr. Bozzo "indicated" that "data from two activities are commingled."

RESPONSE TO USPS/OCA-T4-35. Please see UPS/USPS-T15-13, stating that intermittent reporting of manual parcel piece handlings may reflect periods in which manual and SPBS parcels were commingled; presumably the data would also be commingled.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-36. Please refer to your testimony at page 59, footnote 86. You describe Figure 1 as "a short-run diagram relating small changes in hours and TPH." Please confirm that the description of Figure 1 as representing the "short- run" relationship is your interpretation of the diagram, not Mr. Degen's. If you do not confirm, please explain.

RESPONSE TO USPS/OCA-T4-36. Confirmed. It is clear that Mr. Degen would not agree with my testimony. I am providing an alternate interpretation of the underlying data. I believe that my interpretation is simpler and comports well with the observed data.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-37. Please refer to pages 59-61 of your testimony, particularly footnote 88, where you discuss Figure 4 from Mr. Degen's testimony, USPS-T- 16. In the footnote, you state that you "believe the true cost structure is the line he has labeled '100% Volume-Variability.'"

a. Please confirm that Mr. Degen generated the simulated data in Figures 2 through 4 "by adding random noise to the underlying hours and pieces relationship plotted in Figure 1," as you state at page 59, lines 7-9 of your testimony. If you do not confirm, please explain.
b. Please confirm that the "underlying hours and pieces relationship. . . in Figure 1" is represented in Figure 4 by the set of ten lines crossing the "100% Volume-Variability" line. If you do not confirm, please explain.
c. Please confirm that the set of ten lines crossing the "100% Volume-Variability line, by construction, represent the actual non-stochastic portion of the process that generated the simulated data presented in Figure 4. If you do not confirm, please explain.
d. Please confirm that the line labeled "100% Volume-Variability" line, by construction, does not represent the actual non-stochastic portion of the process that generated the simulated data presented in Figure 4. If you do not confirm, please explain.

RESPONSE TO USPS/OCA-T4-37. (a) Confirmed.

(b) Confirmed that this is Mr. Degen's interpretation.

(c) Confirmed that this is Mr. Degen's interpretation.

(d) Confirmed that this is Mr. Degen's interpretation.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-38. Please refer to your testimony at page 63, lines 1-16, where you present your re-interpretation of Figure 5 from Mr. Degen's testimony, USPS- T-16.

a. In "Mr. Degen's theory of the mail processing network," is mail volume the only factor that will determine the design and size of a mail processing plant? If you claim that it is, please provide a detailed citation to the portions of Mr. Degen's testimony that you use to support your answer.
b. Please confirm that that assumption that the "optimal capacity" for plant A is at the point labeled A in Figure 5, which you state at page 63, line 3, of your testimony, is your assumption, not Mr. Degen's. If you contend that the assumption is Mr. Degen's, please provide a detailed citation to the portion of USPS-T-l 6 that identifies point A as the "optimal capacity" for plant A.
c. Please confirm that that assumption that the "optimal capacity" for plant B is at the point labeled C in Figure 5, which you state at page 63, line 6, of your testimony, is your assumption, not Mr. Degen's. If you contend that the assumption is Mr. Degen's, please provide a detailed citation to the portion of USPS-T-16 that identifies point C as the "optimal capacity" for plant B.
d. Is it correct to interpret the cited portion of your testimony as indicating that you believe point C would also represent the "optimal capacity" for plant A, if plant A's volume were to increase from TPH_0 to TPH_1? If not, please explain what you contend point C represents for plant A.
e. In your interpretation of Figure 5, does the point labeled B represent a sub-optimal operating point for plant A? If it does not (i.e., if point B is optimal), please explain the sense in which point A represents the optimal capacity for plant A, as you assume at page 83, line 3, of your testimony.
f. Please confirm that at point B, the TPH are the same as at point C (i.e., TPH for both points is TPH_1), but the workhours (or "real" labor costs) are lower for point B than at point C (i.e., $HI < HI'$). If you do not confirm, please explain fully.

RESPONSE TO USPS/OCA-T4-38. (a) No. See pages 15 through 23 of Mr. Degen's testimony. However, I do not understand the concepts of "design and size" as stated in your testimony. "Size" could refer to square feet, capacity, complexity of the equipment (*e.g.*, casing boxes having extensions to them, or alternatively, the installation of newer model FSM machines), or possibly the complexity of the sorting process, accompanied by variations in the plant's position in the network. "Design" could, among other issues, focus on the interrelationship between activities at the

processing plant. This was not an issue satisfactorily addressed by Dr. Bozzo and Mr. Degen and might, accordingly, be an important item for consideration by a working group.

(b) Confirmed subject to the recognition that I am using the hours/TPH data presented by Mr. Degen.

(c) Confirmed, subject to the recognition that I am using the hours/TPH data presented by Mr. Degen.

(d) Not necessarily. Point C is a different plant with higher costs. As depicted on the diagram, point C belongs to a different plant.

(e) No, not for the volume going through the plant at that point. It is a point that is different from the design capacity. Given the variations in mail volume, mail processing plants frequently operate at various levels of capacity. Point A is the design capacity of the plant.

(f) Confirmed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-39. Please refer to your testimony at page 40, lines 12-14. You state, "Postal Service investments in capital to reduce operating costs indicate a long-run approach is applicable to the analysis."

a. Please confirm that the antecedent of "the analysis" is Dr. Bozzo's volume-variability analysis If you do not confirm, please explain.
b. Please confirm that you advocate modifying the volume-variability analysis to capture the effects of planned capital deployments intended to reduce operating costs. If you do not confirm, please explain.
c. Does it follow from your statement that you believe that a "short-run" approach would not capture the effects of planned capital deployments intended to reduce operating costs? If not, please explain why a "short-run approach would not also be applicable for the reason given in the quoted statement from your testimony.
d. Please confirm that the Postal Service's rollforward model accounts for, among other things, the effects on the Postal Service's future costs of planned deployments of capital equipment between the base year and test year. If not, please explain your understanding of how the rollforward model treats planned deployments of capital equipment.

RESPONSE TO USPS/OCA-T4-39. (a) Confirmed.

(b) Not confirmed. I indicated that the Postal Service has been making capital investments. One would expect these investments to affect processing costs to some degree. It would appear that the bulk of investments are also being made to establish additional capacity. I do not believe that Dr. Bozzo has significantly addressed this issue.

(c) A short-run analysis presents costs based on a fixed input, such as capital. Planned capital deployments may reduce operating costs and may increase capacity, but it should be noted that changes in capital plant are an element of a longer-run analysis. This is an issue that could well be examined by a working group. I think that a longer run analysis is applicable, for the reasons stated elsewhere in my testimony.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

(d) Not confirmed. I have not presented information on the rollforward model, nor am I familiar with it. Please note that future data are not included in Dr. Bozzo's model, which is based on historical data. The proposed working group might appropriately address the issue of the degree that future costs of planned deployments of capital equipment between the base year and test year are appropriate indicators of economic costs on a long run basis. This may be another example of a potential deficiency in Dr. Bozzo's work.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-40. Please refer to your testimony at page 40, line 21, to page 41, line 1. You indicate that field operating data "probably measure mail processing at a variety of disequilibrium points" and that "accordingly" you "advocate that the regression analysis should be performed on data means." Please explain why it follows from the observation that field operating data represent "disequilibrium points" that "the regression analysis should be performed on data means." Please provide relevant citation(s) to the econometric literature, to the extent you use it to support your response.

RESPONSE TO USPS/OCA-T4-40. From Mr. Degen's testimony as well as various other Postal Service information, I have obtained the impression that there is substantial change in the processing of mail, *i.e.*, that the volume of mail is changing and that there is investment in plants and equipment. See the discussion of mail processing in USPS-T-16. There is also recognition that mail volumes fluctuate substantially; accordingly, it does not appear likely that a plant would be at a specific equilibrium on a continuous basis. A short-run analysis of short run fluctuations would be misleading. This is why I advocated the use of data means. Please also see USPS/OCA-T4-25 for a discussion of the use of a cross sectional model, which could be performed on means.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-41. Please refer to your testimony at page 35, lines 5-6. You state, "the depreciation rates being used appear to be based on accounting data." Please provide detailed citation(s) to the material upon which your statement is based.

RESPONSE TO USPS/OCA-T4-41. In OCA/USPS-T-15-47(d) there is reference to the "book lives" of assets; the concepts of book lives, depreciation, and the 1.5 declining balance formula are accounting techniques. Please also note that the Management Operating Data System feeds the corporate data base, much of which would include accounting data. Dr. Bozzo in OCA/USPS-T-15-47(b) indicates that the economic literature on asset deterioration supports the use of geometric decay over straight line decay, leading, in his opinion, to a consistency between the 1.5 declining balance form and the economic literature. It should be noted that depreciation rates serve as a basis for the estimation of property, plant, and equipment on the balance sheet. It is not unusual for heavily depreciated plant and equipment to have a useful production life. Accordingly, this is an area worth consideration by a working group.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-42. Please refer to your testimony at page 35, lines 14-15. You state, "Older machines will maintain their operability as they depreciate through increased maintenance." Please explain whether, in your view, an "older" machine that requires "increased maintenance" has the more, less, or the same productive capability as a newer machine that requires less maintenance.

RESPONSE TO USPS/OCA-T4-42. I would expect to find the same level of productive capability. On the factory floor, I don't believe that there would be much difference in productivity between two machines of the same model but difference ages as measured in units processed per hour. However, I would expect to find a higher level of maintenance for the older machine.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

USPS/OCA-T4-43. Please refer to your testimony at page 35, line 20, to page 36, line 1. You state, "maintenance labor is carried in another account but is a complement to machine operating time. Accordingly, the study is seriously deficient without consideration of management and maintenance hours."

a. Please confirm that "maintenance labor" is recorded in cost segment 11 in both the Postal Service's and Commission's versions of the Cost and Revenue Analysis (CRA). If you do not confirm, please explain.
b. Please confirm that supervisory labor is recorded in cost segment 2 in both the Postal Service's and Commission's versions of the CRA. If you do not confirm, please explain.
c. With respect to your statement that "maintenance labor. . .is a complement to machine operating time," is it your understanding that the primary direction of causality between "operating time" and "maintenance labor" is that operating time causes the need for maintenance labor, or that maintenance labor causes the need for operating time?
d. By "consideration of management and maintenance hours," do you mean a new analysis of costs in cost segment 2 and/or cost segment 11, an investigation of the possible effects of management and maintenance hours on cost segment 3 costs, or both?
e. If your response to part (d) indicates that the "consideration" means, or includes, an investigation of the possible effects of management and maintenance hours on cost segment 3 costs, please confirm that you have no quantitative evidence that indicate whether the factors you list would actually affect the results of Dr. Bozzo's study. If you do not confirm, please explain fully.
f. If your response to part (d) indicates that the "consideration" means, or includes, a new analysis of costs in cost segment 2 and/or cost segment 11, do you contend that it is, as a general matter, inappropriate to revise the cost methodology for one cost segment unless the methodologies for all related cost segments are simultaneously revised? Please explain fully.

RESPONSE TO USPS/OCA-T4-43. (a) Confirmed.

(b) Confirmed.

(c) Operating time causes the need for maintenance labor.

(d) Neither. I believe that the costs of management and maintenance hours need to be simultaneously considered as related to mail processing plant activities.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-36-43

(e) I do not confirm. Mail processing is a factory type of activity, and I have experience in analyzing a number of types of factory operations, including the manufacture of antipersonnel munitions, transport aircraft, transformers, electrical generation equipment, consumer white goods, fighter aircraft, and certain types of electronics. It has been my observation that equipment age and usage drive maintenance requirements; and that management effort can have a significant impact on the operations. One would naturally expect a study of mail processing costs to address maintenance and management costs.

(f) See my response to parts (d) and (e).

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-44-48

USPS/OCA-T4-44. Please confirm that panel data, by definition, have both cross-section and time series dimensions. If you do not confirm, please explain fully.

RESPONSE TO USPS/OCA-T4-44. Confirmed.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-44-48

USPS/OCA-T4-45. Please refer to your testimony at page 40, lines 10-12. You state, "The concepts of the short run and the long run are clear from the viewpoint of theoretical economics. In the *short run*, some of the factors of production (for example, labor) are variable. In the *long run*, all of the factors of production are variable [emphasis in original]." Please consider a period of time over which some the factors of production are not variable. Please confirm that, "from the viewpoint of theoretical economics," such a period of time would correspond to the economic concept of the short run, regardless of the amount of calendar time involved. If you do not confirm, please reconcile your answer with the statement from your testimony quoted above.

RESPONSE TO USPS/OCA-T4-45. Confirmed on a theoretical basis.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-44-48

USPS/OCA-T4-46. Please refer to your testimony at page 57, line 3. Please provide a precise definition of the term "total cost" as you use it in the cited location.

RESPONSE TO USPS/OCA-T4-46. At page 57, line 3, of my testimony, the term "total cost" means total mail processing cost which is measured in labor hours. Confusion results from the terminology associated with the estimating process. Dr. Bradley uses the term "total cost" in estimating cost equations. With essentially the same approach, Dr. Bozzo indicates he is estimating a labor demand function.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-44-48

USPS/OCA-T4-47. Please refer to your testimony at page 63, lines 11-13. You state, "Figure 5 has two types of plots in it. The facility by facility plots (labeled 'Plant A' and 'Plant B') are the types of plots that both Dr. Bradley and Dr. Bozzo generate and estimate."

a. Please provide detailed citation(s) to Dr. Bozzo's testimony, USPS-T-15, or USPS-LR-I-107, indicating the basis for your statement that Dr. Bozzo generates "facility by facility plots."
b. What, precisely, do you mean by your statement that Dr. Bozzo's estimates 'facility by facility plots'? Specifically, does your statement indicate that you believe Dr. Bozzo's estimation methods are equivalent to estimating regression models separately for each facility? Please explain fully.

RESPONSE TO USPS/OCA-T4-47. (a) Please refer to pages 6 and 7 of *Analysis of Panel Data* by Cheng Hsiao. In performing the fixed effects estimation procedure in the TSP program, Dr. Bozzo obtains different alpha intercepts for each of the mail processing units. A graphical representation of Dr. Bozzo's the work could be represented by Figure 1.1 on page 7. It is in this sense that there are plots of data; strictly speaking, there are no physical plots presented.

(b) Dr. Bozzo estimates his model using the fixed effects approach; this is not equivalent to estimating regression models separately for each facility.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-44-48

USPS/OCA-T4-48. Please indicate the basis for your statement at page 63. line 17, "The mail-processing network consists of over 300 plants."

RESPONSE TO USPS/OCA-T4-48. In UPS/USPS-T-15-25 you will find reference to their being 321 sites in the analysis, and information was subsequently furnished in LR-I-286.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPE/OCA-T4-49-51

USPS/OCA-T4-49. Please refer to your response to USPS/OCA-T4-20. Please also refer to the material you cite from Intriligator. Bodkin, and Hsiao's *Econometric Models, Techniques, and Applications.* As necessary, please assume that the variable z, defined in USPS/OCA-T4-20, is exogenous to the firm's decision process for the purpose of your answer.

a. Please confirm that, in the discussion of the cost curve you cite, Intriligator, Boskin, and Hsiao characterize the short run cost curve as an "alternative expansion path." If you do not confirm, please explain.

b. Please confirm that the material in Intriligator, Bodkin, and Hsiao that you cite implies that the (long- or short-run) cost function and the (long- or short-run) "expansion path" are conceptually identical. That is, in terms of the notation of USPS/OCA-T4-20, the cost function $c = f(y,w,x^*,z)$ represents either the short- or long-run (depending on whether there are "quasi-fixed" factors x*) "expansion path." If you do not confirm, please explain.

c. Please confirm that the material in Intriligator, Bodkin, and Hsiao that you cite implies that the (long- or short-run) labor cost associated with the (long- or short-run) "expansion path" is, in terms of the notation of USPS/OCA-T4-20, given by $c_L = w \cdot h(y,w,x^*;z)$—i.e., the function $h(y,w,x^*,z)$ is defined to equal the derived demand for labor associated with the short- or long-run (depending on whether there are "quasi-fixed" factors x*) cost function or "expansion path" $c = f(y, w^*,z)$. If you do not confirm, please explain.

d. Please confirm that, in the discussion of the cost curve you cite, Intriligator, Boskin, and Hsiao indicate that the short-run cost curve $C_s(y)$ and the long-.run cost curve $C(y)$ must satisfy the relationship $C_s(y) \geq C(y)$ at each level of output, given by y. If you do not confirm, please explain.

e. Please confirm that, given the notation in USPS/OCA-T4-20, the elasticity $\partial \ln c / \partial \ln y = \partial \ln f(y,w,x^*,z) / \partial \ln y$ measures the percentage change in short- or long-run (depending on whether there are "quasi-fixed" factors x^*) cost, moving along the cost function or "expansion path" $c = f(y,w,x^*,z)$, resulting from a percentage change in output. If you do not confirm, please explain.

f. Please confirm that, given the notation in USPS/OCA-T4-20, the elasticity $\partial \ln(w \cdot h(y,w,x^*z)) / \partial \ln y$ measures the percentage change in short-run or long-run (depending on whether there are "quasi-fixed" factors x^*) labor cost, consistent with moving along the associated cost function or "expansion path" $c = f(y,w,x^*,z)$, resulting from a percentage change in output. If you do not confirm, please explain.

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPE/OCA-T4-49-51

RESPONSE TO USPS-T4-49. (a) Confirmed.

(b) Not confirmed. Costs are either fixed or variable, resulting in short run and long run cost functions from a theoretical point of view. Assuming that the question focuses on short run or long run cost functions, to the degree that the notation is consistent with the notation used in Intriligator, Bodkin, and Hsiao, I will confirm.

(c) Not confirmed. Costs are either fixed or variable, resulting in short run and long run cost functions from a theoretical point of view. Assuming that the question focuses on short run and long run cost functions and that the notation is consistent with the notation used in Intriligator, Bodkin, and Hsiao, I will confirm.

(d) Confirmed.

(e) Not confirmed. Costs are either fixed or variable, resulting in short run and long run cost functions from a theoretical point of view. Assuming that the question focuses on short run and long run cost functions and that the notation is consistent with the notation used in Intriligator, Bodkin, and Hsiao, I will confirm.

(f) Not confirmed. Costs are either fixed or variable, resulting in short run and long run cost functions from a theoretical point of view. Assuming that the question focuses on short run and long run cost functions and that the notation is consistent with the notation used in Intriligator, Bodkin, and Hsiao, I will confirm.

ANSWER OF OCA WITNESS J. EDWARD SMITH TO INTERROGATORIES USPE/OCA-T4-49-51

USPS/OCA-T4-50. Please refer to your response to USPS/OCA-T4-21(c). Please also refer to the material provided as Attachment 1 to USPS/OCA-T4-50, which includes page 565 of *The Theory and Practice of Econometrics*, Second Edition, by Judge, et al. Please assume, if necessary, that the page is properly reproduced. Interrogatory USPS/OCA-T4-21(c) related to the conditions under which simultaneous equations estimators are needed, without reference to any particular variable or analysis. Please confirm that a simultaneous equations estimator (e.g., two-stage least squares) is not needed to consistently estimate the parameters of a regression equation for which the explanatory variables consist entirely of exogenous and/or predetermined variables. If you do not confirm, please explain.

RESPONSE TO USPS-T4-50. I am unable to confirm that your exact statement appears in the above-mentioned text. However, the statement, "For statistical purposes the relevant distinction is between jointly dependent variables and predetermined variables" leads to the conclusion that you suggest. Accordingly, I will confirm the substance of your interrogatory.

The Theory and Practice of Econometrics

Second Edition

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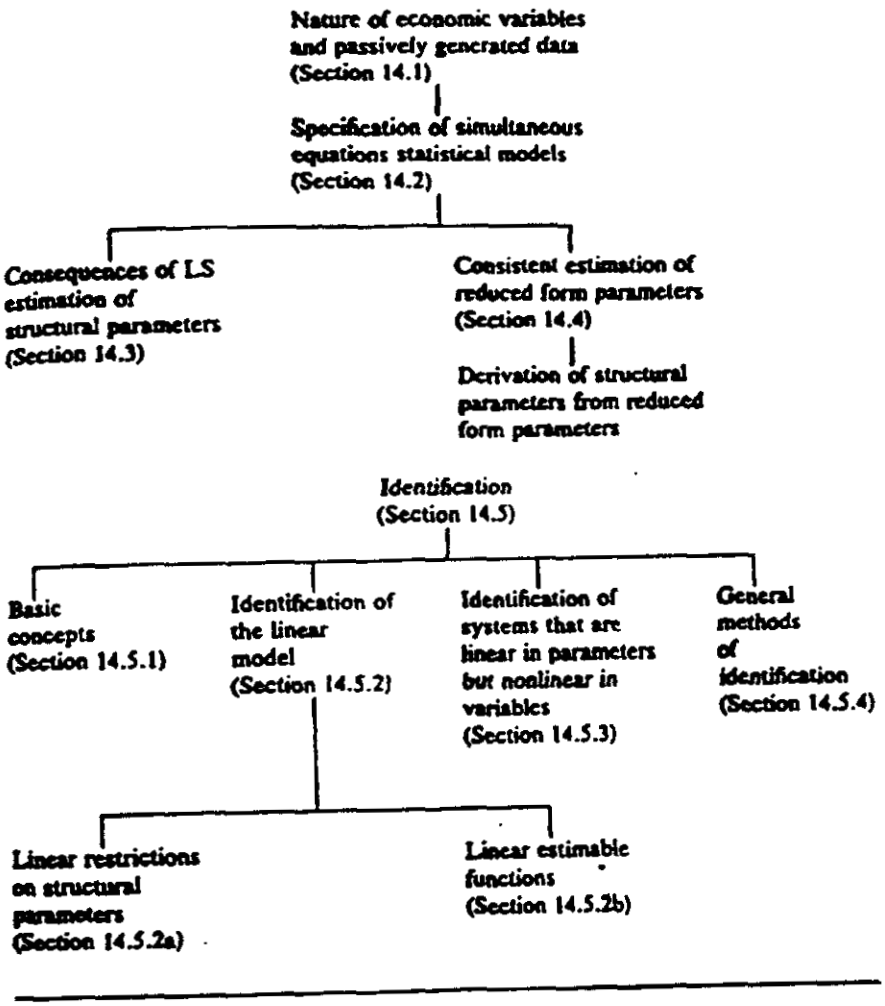
TABLE 14.1 *SPECIFICATION AND IDENTIFICATION OF SIMULTANEOUS EQUATIONS MODELS*



endogenous variables may be placed in the same category as the exogenous variables since for the current period the observed values are predetermined. The exogenous variables and variables that may involve any length of lag are called *predetermined variables*. For statistical purposes the relevant distinction is between jointly dependent variables and predetermined variables.

The final classification of variables involves the nonobservable random errors, or, as they were called in the early simultaneous equation literature,

ANSWER OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPE/OCA-T4-49-51

USPS/OCA-T4-51. Please refer to your response to USPS/OCA-T4-21(d). The interrogatory asked whether it was "your understanding that there is a time lag between the Postal Service's investment decisions and the availability of the related equipment for Postal Service operations." In your response, you state, "Based on information furnished by the Postal Service, it appears that the current level of capital is related to the current level of activity, though not necessarily on a 100 percent basis."

a. Please provide detailed citations to all "information furnished by the Postal Service" you used in formulating your response.
b. With respect to the original question, does the quoted statement from your response to USPS/OCA-T4-21(d) indicate that you do not believe that there is "a time lag between the Postal Service's investment decisions and the availability of the related equipment for Postal Service operations"? Please explain.

RESPONSE TO USPS-T4-51. (a) Please see OCA/USPS-T-15-13; OCA/USPS-T-15-14; USPS-T-10 at 11 lines 19-31, at 20 lines 7-8, and at 31 lines 14-24; USPS-T-16 at 15 lines 1-7; and "gateway to the household", United States Postal Service, *1999 Comprehensive Statement on Postal Operations*, at 4, 83,84,85 and 90.

(b) The concept of "lag" is nebulous. If capital availability during a time period is a function of work during the time period, there is no lag, even though the investment decision may be part of a five year plan, assuming that the plan is correct in its forecasts. There are a number of explicit and implicit assumptions involved in the analysis of an investment decision. In view of the potential importance of an investment decision on the Postal Service, this subject is clearly an area for additional analysis and review; possibly the issues could be clarified and even resolved in a working group focused on segment 3 costs.

CHAIRMAN GLEIMAN: Is there additional written cross examination for this witness?

MR. KOETTING: There is, Mr. Chairman.

CHAIRMAN GLEIMAN: Mr. Koetting, you may proceed.

CROSS-EXAMINATION

BY MR. KOETTING:

Q Good morning, Dr. Smith.

A Good morning, Mr. Koetting.

Q I have handed you a copy of your responses to United States Postal Service Interrogatories USPS/OCA-T4-52 and 53. If I were to ask you these questions today, would your answers be the same?

A Yes, they would.

MR. KOETTING: Mr. Chairman, I would move that Dr. Smith's responses to Postal Service Questions 52 and 53 be transcribed into evidence and I am handing two copies to the reporter for that purpose.

CHAIRMAN GLEIMAN: It is so ordered, that material will be transcribed into the record and entered as evidence.

[Additional Designated Written Cross-Examination of J. Edward Smith, USPS/OCA-T4-52 and USPS/OCA-T4-53, were received into evidence and transcribed into the record.]

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-52-53

USPS/OCA-T4-52. Please refer to your response to USPS/OCA-T4-28(b). In OCA-T-4, do you enumerate the "unrealistic assumptions" upon which you believe the fixed effects model is based? If so, please provide detailed citations to the relevant sections of your testimony. If not, please do so.

RESPONSE TO USPS/OCA-T4-52. In the case of an improperly specified model, please see line 1 at 29 through line 10 at 30; also see line 12 at 45 through line 18 at 46; also see pages 58 through 65.

The lack of variables is discussed at lines 16-18 at 19; and line 13 at 34 through line 2 at 37.

Theoretical problems are enumerated on line 21 at 18 through line 18 at 19; also line 3 at 38 through line 6 at 40; lines 1-12 at 47; lines 14-19 at 51; page 52 through 54.

Problems associated with the short-run analysis include lines 8-16 at 18; and lines 7-13 at 42.

Data Issues are discussed on lines 17-20 at 18; pages 23 through 25; line 11 at 30 through line 2 at 37; line 8 at 43 through line 11 at 45; line 16 at 52 through line 38 at 53.

At a number of points, I have indicated that the study does not meet the Commission's standards. Guidance on these issues was provided in Appendix F, "Appendices to Opinion and Recommended Decision," Volume 2, Docket No. R97-1. For example, the Commission noted that "a fixed-effect is by definition, fixed for all time for a given facility. It can only control for differences across facilities that are constant for all time." (App. F at 10). The Commission had been critical of Dr. Bradley's

approach; I do not see any significant difference in the fixed effects concept between Dr. Bradley and Dr. Bozzo.

The Commission indicated that an estimation procedure relying on the cross-sectional dimension of the panel data set is preferable to the fixed-effect estimator. (App. F at 14). The Commission indicated that the fixed-effect estimator attempts to estimate a short-run relationship between mail volume and costs that is inconsistent with the Postal Service's operating plan over the rate cycle.

The Commission also indicated that by holding the number and size of facilities as fixed, elasticities are flawed because they do not correctly represent the variability of mail processing labor costs for the entire postal system.

The Commission also discussed the volume variability of the manual ratio (App. F at 35). Dr. Bozzo continues to use the manual ratio. A similar argument could be made for the investment variable introduced by Dr. Bozzo.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-52-53

USPS/OCA-T4-53. Please refer to your response to USPS/OCA-T4-31.

a. In your response to USPS/OCA-T4-31(b), item (ii), you indicate that you disagree with the statement enumerated in your response to USPS/OCA-31(a), item (ii) ("Dr. Bozzo maintains that it is not possible to classify all equipment at a site by cost pool."). You subsequently state, "Since some classification may appear to be arbitrary, it would be necessary to determine whether such a classification yields the best answer. However, a correctly performed analysis might not require the division of jointly shared equipment into specific cost pools." Does your response imply that to classify all equipment at a site by cost pool, it would be necessary either to assign some equipment types to cost pools arbitrarily, or to assign some equipment to a separate pool for "jointly shared equipment"? If not, please explain.

b. Please confirm that, in your response to USPS/OCA-T4-31(a), item (vi), your citation to Dr. Bozzo's response to UPS/USPS-T1 5-24 is, more specifically, to Dr. Bozzo's statement, "The effect of including the facility capital index is to capture the net effect on labor demand in a given cost pool of the capital services employed in that cost pool as well as the capital services employed in other cost pools" (Tr. 15/6399). If you do not confirm, please explain.

RESPONSE TO USPS/OCA-T4-53. (a) My answer to the first part of your compound question is no. Arbitrary cost allocations are highly inappropriate. My answer to the second part of the question concerning a separate pool for "jointly shared equipment" is that the concept of "jointly shared equipment" is irrelevant in the single activity modeling being used by Dr. Bozzo and used previously by Dr. Bradley. Both parts of the question illustrate issues inadequately addressed by Dr. Bozzo, and in arriving at a conclusion on variability, one should consider, and probably adopt, some type of joint production analysis. It appears to make little sense to study separately activities that are joint in nature. For example, the manual ratio is computed on data from a number of activities, indicating that Dr. Bozzo and Dr. Bradley both believe that capital is a key variable and that there are elements of joint production. Accordingly, a joint production analysis should be considered.

ANSWERS OF OCA WITNESS J. EDWARD SMITH
TO INTERROGATORIES USPS/OCA-T4-52-53

(b) Confirmed.

CHAIRMAN GLEIMAN: Anyone else?

[No response.]

CHAIRMAN GLEIMAN: If not, that brings us to oral cross. We have received two requests for oral cross, one jointly from that group of eight participants, the Alliance of Nonprofit Mailers, American Business Press, Coalition of Religious Press Associations, Dow Jones & Company, Magazine Publishers of America, National Newspaper Association, McGraw Hill Companies and Time Warner, and, gosh, also from the Postal Service. Who would have thunk it?

Is there any other party that wishes to cross-examine this witness?

[No response.]

CHAIRMAN GLEIMAN: If not, then, Mr. McBride, once again, for that group of participants.

MR. McBRIDE: Yes, Mr. Chairman, and thank you.

CROSS-EXAMINATION

BY MR. McBRIDE:

Q Good morning, Dr. Smith.

A Good morning, Mr. McBride.

Q I believe we met three years ago.

A I guess so.

Q All right, sir. I would just like to ask you a few questions about mail processing costs. Let me begin by asking whether it is good econometric practice to develop an

understanding of the operation you are modeling?

A Yes, it is.

Q And is it, therefore, fair to assume that you have developed a good understanding of mail processing operations that you modeled?

A My knowledge of mail processing operations is based on the information presented in this case, and I assume that it is sufficient, since, otherwise, the Postal Service could not have presented such information.

Q Have you been to Postal Service mail processing facilities?

A Yes, I have.

Q Several of them?

A I have been to a number of facilities, probably only one Segment 3 facility.

Q Well, let me ask you some operational questions. I am going to ask you to assume the Postal Service is about to run an incoming secondary sort scheme on a Flat Sorting Machine Number 881. Do you follow that assumption?

A I do.

Q Would you agree that the first thing the Service would have to do, or the personnel performing the operation would have to do is to set up the scheme on the Flat Sorting Machine 881, is that correct?

A That is correct.

Q Now, what does that entail?

A I really couldn't comment on that since my knowledge is limited to that presented by Dr. Bozzo, Mr. Degen, previously by Dr. Bradley, and such information as I have observed on my own. I am not an expert on Postal plant operations. My knowledge is limited to approximately the knowledge introduced in this case. Obviously, the short answer to your question is they set it up for the operation to sort it.

Q Do you know if, in running the sort scheme, they would load the machine, key the mail and sweep the bins?

A That is my understanding. I saw people doing such.

Q All right, sir. And then at the end of the run, they sweep all the bins, is that correct?

A I assume that they do. I think that was indicated.

Q And that is your general understanding of how the process works?

A That is my understanding of how the process works.

Q All right, sir. And then I would ask you to assume that I am going to add one more piece of flat mail to the typical incoming secondary sort scheme on this FSM 881. Do you follow that assumption?

A I do.

Q There would be more actual sorting costs under my assumption, would there not?

A There would be a very small amount of additional time spent sorting one more piece of mail.

Q So that would produce additional cost, however small?

A Very small, but, yes, it would.

Q All right. And would there be more set-up costs under that assumption?

A I doubt it.

Q Would it take longer to run, longer to sweep the bins at the end of the run?

A Probably not.

Q So, under my assumptions, some costs are variable, but some are pretty much fixed?

A We are talking about a short run cost analysis, and that is very definitely the case.

Q Are there fixed costs incurred by the Postal Service in general?

A Over the time period that would be relevant for the measurement of costs, it would appear that they are 100 percent variable, but we are talking about the long run, we are not talking about the daily sorting, sweeping, setting up, bin emptying and whatever.

Q How about for the time period between rate cases,

would your answer be that there are fixed costs during that time period?

A The Postal Service witnesses have indicated that it takes them approximately one year to change -- one to two years to change machinery configurations. So it does not appear likely that costs would be strongly fixed. In other words, it leads you to the conclusion that over a period of one to, say, three years, many things are variable.

MR. McBRIDE: For now, Mr. Chairman, that is it. Thank you.

CHAIRMAN GLEIMAN: Mr. Koetting.

MR. KOETTING: Thank you, Mr. Chairman.

CROSS-EXAMINATION

BY MR. KOETTING:

Q Dr. Smith, I would like to direct your attention first to your response to Postal Service Interrogatory 33, please.

A I have it.

Q You indicate in your response that you neither agree nor disagree with the statement that growth in delivery points must be considered part of the growth in volume. And you also describe errata to your testimony, quote, "Removing the" -- well, which removes from your definition of volume variability the condition that delivery points and other volume -- non-volume factors are held

constant. Is that a fair summary of your response?

A Mr. Koetting, could you restate that, please?

Q Sure. You indicate two things in your response. First, that you neither agree nor disagree with the statement that growth in delivery points must be considered part of the growth in mail volume -- part of the growth in volume, is that correct?

A That is correct.

Q And you also describe errata which removes from your definition of volume variability the condition that delivery points and other non-volume factors are held constant?

A That is correct.

Q And you change the definition of volume variability, you have changed -- that appears on page 5 of your testimony, correct, I believe?

A I haven't changed the definition of volume variability. I have changed what I said in the testimony. Now, I will check page 5, but I am sure that that is correct. What line are you on?

Q In the original page, it was on lines 4 through 6. My recollection is in the revised page, we didn't even have line numbers. I could be mistaken on that. I am referring to the definition in the original version that was page -- on lines 4 through 6.

A Well, we will take it subject to check that it is. I don't have page -- lines 4 to 6 in front of me on the original.

Q Would you say that the definition of volume variability is central to the measure of volume variable cost?

A Yes, it is.

Q In your response to Postal Service Interrogatory 34, we asked you whether or not you were modifying your definition and you said yes. We also asked you why --

A Excuse me, Mr. Koetting, I didn't say that. I did not say yes to that question. The question I said yes to is the one in your question on the paper which I says I have modified my response. I did not modify the definition.

Q Okay. The question, as I read it, is in the last sentence of your response you appear to modify the statement quoted from page 5, lines 4 to 6, of your testimony.

A That's correct.

Q And your statement was not a statement of a definition?

A What I have stated is what is there, I have modified the statement. The definition is unchanged. It is the same definition as Dr. Bozzo and Dr. Bradley have used.

Q So, do you intend to use the same definition of volume variability as Dr. Bozzo does in this proceeding?

A Yes, I do.

Q Can we turn to your response to Postal Service Interrogatory Number 49, please?

A I have it.

Q You repeat the statement in several of those subparts, (b), (c), (e), and (f) of the interrogatory.

In each instance, your response reads, not confirmed. Costs are either fixed or variable, resulting in short-run and long-run cost functions from a theoretical point of view.

Assuming that the questions focuses on short-run or long-run cost functions, to the degree that the notation is consistent with the notation used in Intriligator, Bodkin, and Hsiao, I will confirm.

When you say that you're not confirming in each of those instances, are you declining to confirm because of something about the statement's characterization of short- and long-run cost functions?

A I just didn't like the way you phrased the question; it was nebulous, and so I stuck to the work that I have quoted by Drs. Intriligator, Bodkin, and Hsiao.

Q Let's take Number B. Do you want me to run through Number B for a second?

A No, that's fine; let's move on.

Q Let's look at Postal Service Interrogatory 28(a),

please.

[Pause.]

A I have it.

Q In Subpart (a), you were asked if it was your testimony that Dr. Bozzo did not allow for the treatment of the data on a pooled basis or a cross-sectional basis.

You responded, yes, and --

A That's correct.

Q And by way of explanation, you stated that Dr. Bozzo used the fixed effects method, and rejected the pooled and cross sectional approaches, correct?

A That's correct.

Q Is the cross sectional approach to which you refer, the so-called between model?

A That's correct.

Q And is your understanding that Dr. Bozzo presented estimates for the pooled and between models?

A Yes. They are in his testimony.

Q In response to Subpart (b) of Question 28, you indicated that Dr. Bozzo performed statistical specification tests related to the choice of estimation methods, although you disagreed with those tests; is that correct?

A I disagree with Dr. Bozzo's modeling approach. To be specific, Dr. Bozzo has looked at a bunch of short-run costs when he should be looking at the longer-run costs.

He's injected -- he does not -- he's injected investment into it without having a simultaneous equations model. He's got a manual ratio that doesn't seem to work, and in terms of specifically rejecting the pooled model, I understand that it does not pass the tests.

On the other hand, I don't think he's got the right variables on the right-hand side, and so I don't know whether it would pass the tests or not, if the model were correctly specified.

So I guess I'm rejecting his rejection. Now, there are other things wrong with the modeling effort, but --

Q Well, let's stick with the pool and the between estimators that we're talking about right now.

A Sure. But in the case of the pooled, I will agree that he has rather succinctly set forward that the pool is rejected on a statistical basis, and that's the same conclusions that Dr. Bradley arrived at earlier.

Q In Subpart (b), you were asked whether the question of whether or not the pooled or between estimation methods are consistent with the data, can be answered with a statistical specification test or tests, and you responded, no; is that correct?

A That's correct, in the context that I'm stating things, yes, that's correct.

Q Does your negative response indicate that it's your testimony that the choice of modeling approach is part of the analysis that is not subject to empirical testing?

A I think the choice of modeling approach is key to this study, and I don't think he has done that yet in terms of a correct model, so I think it's a little premature to be rejecting one or another of these.

I'd like to see an affirmation or denial of the model, once it had been correctly specified.

Q But in terms of whether or not the model has been correctly specified, that's something that is not subject to statistical testing?

A It would be testable, once we've got something to test.

Q If we could look at your testimony at page 67?

A Okay, I have it.

Q And I am looking at essentially the bottom half of the page -- well, let's say lines 9 through 15, including Table 6.

In Table 6, do you provide results from the pooled OLS regression of the natural log of cost pool hours on a constant, and a natural log of cost pool TPH with data from Dr. Bradley's datasets?

A These are data from Dr. Bradley's datasets, as I believe. And it's just based on one of -- these are log

data, yes.

Q And are the numbers in the regressor column of Table 6, are those the estimated regression coefficients?

A Yes, they are.

Q Natural log of TPH?

A Yes.

Q And at lines 14 through 15, you state that the lines show that a simple visualization of a straight line through the data suggests a high level of volume variability?

A Yes.

Q And by, quote, "the lines," end quote, do you mean the regressions you estimated for Table 6?

A Would you give me the line number you're looking at here?

Q Okay, line number 14, the sentence beginning, "however."

A No, I'm referring to just the ability to eye-ball a line through. There is no line specifically set there. It's left to the reader's imagination to put a line through there visually.

[Pause.]

Q So when you talk about the regression lines in line 12, that's a different thing than the lines that you're talking about on line 14?

A It would be much clearer to say the regression approach is econometrically indefensible.

Q So now you've got me confused. The lines mean -- you'd rather just avoid using the term, lines, on line 12, and say regression approach.

A Now that you've called it to my attention, I think it's a very poor way of phrasing it.

To make it crystal clear, the regression approach is econometrically indefensible, and, in fact, the point was not to show that it was econometrically correct; just to show that you could imagine things sort of go together.

In other words, a lot of this stuff sort of goes together, the total pieces handled and the hours associated with the labor, sort of, just by eye-balling it on the graph, seem to just sort of flow together.

Q But now, again, we're -- I'm back on line 14, and for better or worse, in your testimony, as submitted, you did refer to the lines.

A Yes.

Q And you've kind of said you would prefer to restate the sentence that begins on line 12 to talk about an approach.

A Yes.

Q But we still have the lines on line 14, and are those the regression lines?

A A regression line through the data that is in the graphs. If it could be visually imagined as a simple visualization, as I say, of a straight line through the data, suggests a high level of volume variability.

Q So, does that suggest that what you're doing in Table 6 here is essentially to quantify the visual analysis from your R97-1 testimony?

A This is based on Dr. Bradley's programs, which I think are based on a difference between the mean. He did an adjustment from the mean, and did several other things.

So, those lines would not show the lines that I think that I'm talking about in 14, but if you'll look at the R-squared, all it says is that LSM, for the LSM, TPH and hours, sort of vary together fairly closely.

Q But would it also be correct that on the basis of what you're saying beginning on line 12 that we just discussed, that these regressions are econometrically indefensible?

A Yes, they are.

Q So what you're saying is that the visualization of a straight line through the data corresponds to regressions, but those regressions are econometrically indefensible?

A Right. They need to be modified, but just using Ockham's Razor, just to see how data vary, in other words, before we do anything intensive in an analysis, just to see

if anything makes sense, we can see that total pieces fed or total pieces handled -- Dr. Bradley used handled -- versus hours, they seem to go together pretty well, and, therefore, any argument that they don't needs to be very carefully specified.

Q I'd like to turn to pages 62 and 63 of your testimony.

A I have it.

Q On page 62, you have reproduced a Figure 5 from Witness Degen's testimony; is that correct?

A Yes, I have.

MR. KOETTING: For the convenience of the Commission and anybody else who might not have it handy, I have copies of that Figure 5, which has simply been blown up so that we can all make sure we're talking off of the same figure.

[Pause.]

THE WITNESS: I have one, thanks.

BY MR. KOETTING:

Q I'd like to focus specifically on page 63, lines 3 through 5, and then again lines 11 through 13, if could take a look at those, please?

A I've looked at them.

Q Would it be correct to say that your interpretation of the lines labeled Plant A and Plant B,

that they represent the short-run cost relationship for the plants?

A Well, actually, they're labor demand functions, according to Dr. Bozzo, but they are short-run, and they represent how total piece handlings vary.

You left off the other side of the graph, the Y axis, and that Y axis is hours. Maybe we might want to write it in.

Q That's fine. I certainly agree with you that that appears on your testimony, and this is just for purposes of those who might want to follow along in the hearing room.

Actually, I believe the axis is there; it's simply the label for the axis that's missing, which is hours?

A Well, frankly, I don't see the axis either, on my copy.

Q It's not material. So, let's go back -- and I'm a little distracted, so let me -- you agreed that the Plant A and the Plant B lines represent short-run, but you had some reservations about cost relationships, the term I used to describe it?

A Well, we get back to the issue of what are we measuring. And a factor demand function, if I might turn to the book by Intriligator, Bodkin, and Hsiao, has, according to them, W-1, W-2, and P, and it's labor demand function.

Dr. Bradley was talking in terms of a cost

function in much the same data where he had W-1, W-2, and Y.

I'll accept that Dr. Bozzo believes this is a labor demand function.

Q Well, I didn't ask you about that. What I'm asking is, does it represent cost relationships?

A It represents them. Well, I don't see any costs here. I see hours and I see piece handlings. When I go to the store, I pay dollars.

On the other hand -- and so I don't see cost, but I will say it's resource utilization as a function of total piece handling.

Q Well, let's look at page 63 of your testimony, line 8.

A Yes.

Q You say that you're directing your attention to Points A and C, and you say they represent the real labor cost of processing mail at each of the plants.

A By his standards, yes, they do.

Q Okay, so, the fact that there is no costs, per se, on the graph, doesn't seem to be an impediment to that portion of your testimony?

A It's an impediment to the longer-run analysis of this study, because we're assuming that hours are a proxy for cost. We discussed that in the last proceeding with Dr. Bradley.

I continue to have reservations about that, but we'll accept it as it is right now, if that's what you would like.

Q Well, I'd just like for you to accept it as you did in your testimony.

A That would be fine.

Q I'm just using the words from your testimony.

A That would be fine.

Q The line through points A and C represents the longer term cost relationship then, is that correct?

A That's correct.

Q And at lines 3 and 6, do you interpret points A and C as the "optimal capacities" for the two plants?

A I do.

Q And staying with this material, could you turn for a moment to your response to Postal Service Interrogatory 38 where it is discussed as well?

A I have Interrogatory 38 in front of me.

Q Could you turn to part (e) which asks you, does the point labeled B represent a suboptimal operating point for plant A? And your response stated no. You also stated that it is a point that it is a point that is different from the design capacity. Is that a fair characterization of your response?

A Right.

Q To clarify then, does your response and this subsequent explanation indicate that you interpret point B as being an optimal operating point, or a not optimal operating point?

A They would appear to be points along the hours-TPH relationship, on the assumption that the plant is operating at efficiency. When we talk about optimal point, I, of course, interpreted that in line with the information Dr. Bozzo introduced to this case about Dr. Toda, -- I assume it is Dr. Toda, but I don't know that, -- in which Dr. Toda discusses state plants and whether they achieve cost minimization.

I am assuming that plant A, when it has this relationship, is operating in a cost minimization mode.

Q So, to go back to my question, I think what you said there for the point B is an optimal operating point for plant A?

A It is not the point at which the plant, by my standards, would have been designed for, which was A, but if they are going to have that much -- that many handlings, that is where they are going to operate.

Q And so what you are saying is that both point A and point B represent optimal operating points for plant A?

A They represent the minimum point in terms of they can't do any better given the level of output, if that is

what you mean. Now, if you mean would you design a plant for -- to handle amount A, if you expected amount B, the answer is, no, you would not. So, if you are using optimal in that sense, no, it is not optimal.

Q Let's look at your response on subpart (d) of that same Interrogatory 38.

A Yes.

Q Does your response indicate that point C would not necessarily represent the optimal capacity to point A would expand if the amount of processing it performed increased from TPH sub zero to TPH sub 1?

A C is a different plant, and so I have trouble talking about plant A expanding. In fact, Dr. Bozzo has indicated that due to the fixed effects of various plants, they have different costs, so one could imagine that, for example, a rural plant that expanded would be a bit different from an urban plant. That is why I said -- gave you that answer.

Q If it is your interpretation that point C doesn't represent the optimal capacity for plant A when its volume increases from TPH sub zero to TPH sub 1, why do you contend that the line between points A and C represents, as you call it, the longer term capacity expansion path?

A Because it is the point along which the plants' optimal -- their design capacities will lie as plant sizes

vary. But I am not talking about varying plant A, I am just saying as plant size is varied.

Q If we could turn to your response to Postal Service Interrogatory Number 2.

A I have it.

Q You provide in that response a lengthy quote from Intriligator, Bodkin and Hsiao in response to a question which asks you about the meaning of the term "equilibrium point" as you use it in your testimony at page 13.

A Right.

Q Directing your attention in particular to the last two sentences of the first paragraph, and that is the first paragraph of the quote, is it correct to say that the quote you provide discusses economic equilibrium in the context of profit maximization?

A Yes, it does.

Q Let's move to your response to Postal Service Interrogatory 7.

A I have it.

Q In subpart (b), there is citation to a table in Chung's utility and production functions, listing a number of empirical studies that employed the translog functional form. Did you review any of the original studies listed by Chung yourself?

A Not at all.

Q And in your response, you indicated that the selected studies, variously, time series, cross-sectional and pool data, is that correct?

A That's correct.

Q And pool data means panel data, that is, data with both a time series and cross-sectional dimension?

A Yes.

Q And you note that Chung states in a footnote that cross-sectional analysis yields long run effects, whereas, time series analysis yields short run effects, is that correct?

A That is correct.

Q Do you agree with that statement?

A That cross-sectional analysis yields long run effects, yes. In fact, I think you will also find that in the Commission's Appendix F to the last rate case.

Q If panel data have both a time series and a cross-sectional dimension, how, if at all, do you believe it fits into Chung's statement about the length of run represented by times series and cross-sectional analyses?

A I am not at all -- I honestly don't understand your question. Could you break it maybe into two parts and we will try to hit each of them?

Q Okay. I think we agreed a minute ago the panel data have both a times series and a cross-sectional

dimension, is that correct?

A Right. Yes.

Q Now, we have got a statement that cross-sectional analysis yields long run effects, correct, from Chung, which you said you agreed with?

A Yes.

Q And time series analysis yields short run effects, correct?

A Right.

Q Now we have got panel data that have both a time series and a cross-sectional dimension.

A Right.

Q How does that fit into Chung's statement about the length of run represented by time series and cross-sectional analyses?

A Well, I think for the case under analysis here, you would want to use a cross-sectional analysis rather than use the fixed effects, because I think when you do this fixed effects, you are picking up short-term adjustments.

Q If we could look at your response to Interrogatory 47(b).

A Yes, I have it.

Q In that instance, didn't you state that the fixed effects estimator used by Drs. Bradley and Bozzo is not the same as running time series regressions for the individual

facilities?

A Well, addressing number (b), does your statement indicate that you believe Dr. Bozzo's estimation methods are equivalent to estimating regression models separately for each facility? I have said no. To be specific, if you were to just segment the data or selectively cull it out so that you ran a separate regression model for each facility, you would get a different equation than if you ran it as fixed effects model.

Q Those would be time series equations?

A If you were to -- yeah, we are talking here about running time series analysis. Yes, these are time series.

Q Let's go to your response to Postal Service Interrogatory Number 8, please.

A I have it.

Q The question there was to provide detailed descriptions of any analyses you performed for any reasons pertaining to your testimony. And in the last paragraph, you describe some SAS runs that you have done and state, "I did not view these regressions as worthy of reporting or retention." Can you elaborate on that a little bit, please?

A I threw them out. I threw them out after I ran them because I felt that what I was doing was meaningless in that case.

Q Do you recall with any more detail what it was

that you were attempting to do?

A No, actually, I was a little frustrated when that interrogatory came in because I would have liked to have shipped a whole bunch of stuff to you, but -- just to show that they were -- that I am telling the truth, that they were worthless, but they were worthless, and so I threw them out.

Q I am not doubting that they were worthless. I am just wondering if you could tell me what it was that you were attempting to do, what was the nature of the SAS runs?

A I was just attempting to hold various -- take variables out and put variables in. But there were very limited variables in -- and I was using Dr. Bradley's programs, but the variables that he had furnished were really very limited, and the approaches were really not very consistent with what I would advocate, so I think I spent all of about two hours on this, and at the end of two hours, said there are better things to do. There is no smoking gun.

Q I am perfectly willing to represent -- to accept your representation that there is no smoking guns. I would note, however, that your answer does refer to various other data other than Dr. Bradley's. Do you recall offhand what any of those were?

A Yeah. Oh, yes, certainly. I had gathered -- I

got some data off of various Postal records where I sort of tried to see what could be done on a longer time series basis, but decided that the results were meaningless due to lack of variables and I had some questions about whether I even understood what the data were, and that is part of the two hours.

Q Fine. If we could just turn to your response to Interrogatory, Postal Service Number 12.

A Okay.

Q Subpart (a), just to clarify, the question was phrased as a please confirm, and is it correct that your response is confirming or not?

A I will say it confirms.

Q Similarly, with part (b), you were asked, is it your testimony that the investment programs designed to reduce mail processing costs, to which you refer, would reduce costs in every cost pool? You have an answer explaining your views. Would that -- could that be preceded by a yes or a no, in your view?

A No, subject to extensive qualification. And my knowledge of Postal Service investment and the motivations for this investment is mostly limited to the writings of the Postmaster General plus several other reports and that type of stuff, in which it is indicated that the Postal Service has two things underway, one, the attempt to increase its

ability to handle mail in larger volumes. That seems to be what we are talking in this case. And the other part of it is that in some way, they want to reduce costs to become more competitive with some of the newly emerging or increasingly competitive competitors that they face.

And so, there are these two types of investments, although they do seem to be strongly commingled, and it would appear that most investment, where it occurs, is focused on being cost minimal as they expand capacity.

Q Could we turn, please, to your response to Postal Service Interrogatory 39, part (d)?

A Excuse me, that is (b) as in boy?

Q No, I'm sorry, (d) as in dog.

A Yes, I've got it.

Q Again, just to clarify, the question asked you about the Postal Service's Roll Forward Progrgam, and you said not confirmed.

Would it be correct to say that you're declining to confirm, not because you necessarily disagree with the statement, but because you simply lack particular information or knowledge to agree or disagree?

A I have not testified to having any expertise in that area, and my failure to confirm represents a lack of knowledge on my part.

Q Getting away from the Postal Service's

interrogatories for a moment, AAP Interrogatory Number 1(a) to you --

A Okay, I have that.

Q And the question was, please confirm that in the long run, the factors of production that are variable at the Postal Service include all wage levels and work rules that are in effect under the Postal Service's existing contracts.

And your response was not to confirm, and you specified that labor is a factor of production and would be variable in the long run.

But you say work rules are not a factor of production. The question talked about wage levels and work rules, and your response refers to labor and work rules.

And I think I understand the distinction between labor as an input, and work rules and wages that are not actually the input. But are you distinguishing between work rules and wages here? Would you put both of them as outside the category of factors of production?

A Work rules are a constraint. Labor is an input. Wages, in the long run, are variable, however, when we come to the actual implementation of Dr. Bozzo's analysis, we're not modeling wages; we're modeling costs, hopefully.

And the employment of various categories of labor may result in various wage rates being applicable to the cost of production during that timeframe, so having said

that, I think that's the answer to your question.

Q Okay, so that in hte long run, the work rules that you indicated, I believe, were binding, would -- to reach the long-run state, they would have to no longer be binding; is that correct?

A Yes, assuming that they are binding, and also assumign that they haven't already been factored into teh wages.

Q Okay.

MR. KOETTING: I believe that's all we have, Dr. Smith. Thank you very much.

THE WITNESS: Thank you.

CHAIRMAN GLEIMAN: Is there any followup?

MR. McBRIDE: Yes, Mr. Chiarman, very breiefly.

FURTHER CROSS EXAMINATION

BY MR. McBRIDE:

Q Dr. Smith, is the long-run, as you have testified, the point at which all inputs can be varied?

A That is the economic definition of the long run.

Q Thank you, sir. Does that mean that at the point at which all inputs can be varied; that is, the long run, inputs can be substituted for one another and maximum efficiency is reached?

A Yes.

Q Does it follow, therefore, that mail processing

costs increase leass as volume increases in the long run?

A I haven't testified to that. I would think that mail processing costs exhibit constant returns to scale, and that they would increase comcomitantly with the flow of mail.

Q But didn't we just agree that inputs could be substituted for one another and maximum efficiency would be reached at that point?

A Yes, we did.

Q And would it not therefore follow that in an efficient operation, management could substitute one input for another, and that, therefore, one would expect processing costs to increase less as volume increases?

A Well, we really haven't defined that the Postal Service is or is not right now at a point of efficiency or inefficiency.

And so if you wish me to say if we have an inefficient operation, and if it enters the long run, can its efficiency increase, the answer is, I don't know, because, as an economist would define efficiency, we're talking about pricing in a competitive market where marginal revenue equals marginal cost.

And in the case of the Postal Service, there is reason to believe, based upon the Postmaster General's testimony, that they probably operate where eithe average

cost or marginal cost equal demand, rather than marginal revenue.

Q Do you recall, though, I didn't ask you about the Postal Service now; I asked you about the long run. We're not in the long run right now, are we?

A Well, I'm not sure that in applying that to the analysis -- I'm not sure whether we can answer that question and whether that's an answerable question.

Q Well, in any event, I just want to confine my question to the long run, which was the basis for my earlier questions. In the long run, where we agreed all inputs are variable, and maximum efficiency could be reached; do you recall those assumptions?

A Yes, and I just told you --

Q Let me finish my question. I didn't finish it.

I just asked you then, at that point, that is, in the long run, would it follow that mail processing costs would increase less as volume increases?

A And I have said, not necessarily. I've raised the issue that was raised initially by Dr. Bradley -- excuse me, Dr. Bozzo, in terms of the Toda discussed type of enterprises, which will never achieve efficiency.

On a practical basis, it would be my expectation, in the long run, that as volume increases, costs would increase proportionately.

However, theoretically, you could get any other answer, and we don't have an answer at this moment.

MR. McBRIDE: Thank you, Dr. Smith.

CHAIRMAN GLEIMAN: Is there any other followup?

[No response.]

CHAIRMAN GLEIMAN: Questions from the Bench?

[No response.]

CHAIRMAN GLEIMAN: I don't believe so. Would you like some time with your witness to prepare for redirect?

MR. RICHARDSON: Just a couple of minutes, Mr. Chairman.

CHAIRMAN GLEIMAN: Certainly.

[Recess.]

CHAIRMAN GLEIMAN: Mr. Richardson?

MR. RICHARDSON: Mr. Chairman, we have no redirect.

CHAIRMAN GLEIMAN: If there is no redirect, then, Mr. Smith, that completes your testimony here today. We appreciate your appearance, your contributions to the record. We thank you, and you are excused.

[Witness Smith excused.]

THE WITNESS: Thank you, Mr. Chairman.

CHAIRMAN GLEIMAN: That concludes today's hearing, and we'll reconvene tomorrow morning, the 14th of July, at 9:30 a.m., at which point we will receive testimony from

Witnesses Navasky, Schroeder, Wells, Sheketoff, Ball, and Nelson. Witness Erickson, who had been scheduled to appear tomorrow, has been rescheduled to appear on the 21st.

Have a nice afternoon and evening.

[Whereupon, at 12:40 p.m., the hearing was recessed, to be reconvened on Friday, July 14, 2000, at 9:30 a.m.]