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BEFORE THE
POSTAL RATE COMMISSION

POSTAL RATE AND FEE CHANGES, 2006	:	**DOCKET NO. R2006-1**

DIRECT TESTIMONY OF KEVIN NEELS ON BEHALF OF UNITED PARCEL SERVICE

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BIOGRAPHY

My name is Kevin Neels. I am a Principal at The Brattle Group, an economics consulting firm headquartered in Cambridge, Massachusetts. I lead that company's transportation consulting practice. I have more than 30 years experience providing economic analysis, research, and consulting services to a wide range of clients. These clients have included government transportation agencies, as well as firms in the postal, railroad, airline, and auto manufacturing industries. My work has frequently addressed issues relating to regulatory policy and the proper relationship between the public and private sectors.

Prior to joining The Brattle Group, I served with a number of other organizations, including Charles River Associates (now known as CRA International); the Rand Corporation; the Urban Institute; Peat, Marwick & Mitchell (now known as KPMG); and the consulting firm of Putnam, Hayes & Bartlett. I am a member of the American Economic Association and Vice Chairman of the Committee on Freight Transportation Economics and Regulation of the Transportation Research Board, an arm of the National Academy of Sciences. I hold a Ph.D. from Cornell University. A copy of my resume is attached as Appendix A.

On a number of prior occasions, I have been asked to offer expert testimony in legal and regulatory proceedings, including testimony relating to the regulation of postal rates. In particular, I have testified for UPS before this Commission. In Docket No. R97-1, I submitted testimony on a statistical analysis of mail processing cost variability presented by Dr. Michael Bradley on behalf of the United States Postal Service. In Docket No. R2000-1, I submitted testimony criticizing an updated version of that same study prepared by Dr. Thomas A. Bozzo.

In Docket No. R2000-1, I also submitted testimony regarding purchased transportation costs. My testimony addressed a number of issues, including the attribution of the costs of the aircraft dedicated to the delivery of time sensitive products and potential biases in the systems used to measure the composition of mail carried on the Postal Service's ground transportation network.

PURPOSE AND SCOPE OF TESTIMONY

My testimony addresses three issues. First, I discuss the redesign of the In-Office Cost System, with a particular focus on the treatment of parcels. I then address two areas in which the Postal Service has proposed a reduction in the attribution of significant cost segments. These are the econometric study of mail processing costs presented by Dr. Bozzo, and the proper treatment of the costs associated with the Federal Express Day-Turn Network.

My testimony is based in part on a workpaper, identified as UPS-T1-Neels-WP-1.

THE IOCS REDESIGN IMPROVEMENTS SHOULD BE EXTENDED TO PARCELS.

In his testimony designated as USPS-T-46, Dr. Thomas A. Bozzo describes an extensive effort to redesign and update the In-Office Cost System ("IOCS"), the statistical system that plays a key role in developing distribution keys for Cost Segment 3 (mail processing and window service costs). With this redesign, the Postal Service sought to preserve the basic structure of the IOCS while both streamlining its administration and improving its accuracy. I conclude that this effort has been largely successful. The improvements appear to be well thought out, and well-grounded in modern interview-based data collection practice. Moreover, the results obtained have validated its accuracy. I support the Postal Service's efforts in this area.

Although the redesigned IOCS methodology significantly improves prior practice, one issue deserves additional attention. In the spirit of urging the Postal Service to complete the commendable work it has begun, I urge it to correct a deficiency in its treatment of parcels.

In Table 4 of his testimony (at page 28), Dr. Bozzo compares IOCS tallies for Base Years 2000, 2004, and 2005. IOCS tallies for Base Years 2000 and 2004 were derived using the old methodology. The tallies for 2005 – the base year in this case – were derived using the updated methodology. Table 4 reveals a significant increase in the percentage of direct tallies – tallies in which it is possible to identify the class of mail with which the sampled employee is working. Direct tallies are crucial to the proper formation of distribution keys and the accurate attribution of costs to mail classes. In Base Year 2004, direct tallies made up 42.9 percent of all mail processing tallies. However, in Base Year 2005 this percentage rose significantly, to 47.7 percent.

Moreover, not-handling tallies -- a significant source of controversy in past cases – fell by a corresponding amount, declining from 42.6 percent to 38.3 percent of the total.

Dr. Bozzo attributes this improvement to a better system of "prompts" added to the new IOCS data collection software. The prompts require a sampled employee who is not holding mail but is working in an automated operation to select a piece of mail from the feed stream of the operation in which the employee is working.[1] While these instructions were part of the old IOCS procedures, Dr. Bozzo hypothesizes that data collectors may have underutilized them, with the result that sampled employees selected mailpieces less often than they should have. Unlike the old system, the redesign prevents the data collector from proceeding without prompting the employee to select a piece of mail. This change appears to have increased compliance with the rules, thereby generating the increased proportion of direct tallies.

This improvement is laudable. However, it appears that a sampled employee is prompted to select a piece of mail from the equipment only if the employee is working with letters or flats, but not when working with parcels. The IOCS fieldwork instructions specify in Isolation Rule I-9 that:

> If the employee is not handling mail, Postal Service forms, or any type of mail container, but is working in an automated or mechanized *letter or flat* processing operation with mail present, obtain the first available mailpiece from the machine's source of supply.[2]

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[1] USPS-T-46, p. 29.

[2] USPS-LR-L-21, Data Collection User's Guide for In-Office Cost System, pp. 7-16 (emphasis added).

Dr. Bozzo has confirmed that the rule is implemented only for letter and flat operations, but not when employees are working with parcels:

> The automatic prompting occurs for tallies where letter or flat sorting equipment is indicated as being used (Q18C1 responses A-B, Q18C1.BMC response A) and mail is present in the operation. Automatic prompting is not implemented for other types of equipment.[3]

Table 1 compares Base Year 2004 and Base Year 2005 IOCS data for mechanized and automated operations. To produce this table, I have followed the logic and assumptions used by Dr. Bozzo in preparing his Table 4.

Table 1

Effect of IOCS Redesign on Direct Tally Percentages by Shape

		Direct Tally Percent			
Line	**Shape**	**BY 2004**	**BY 2005**	**Change**	**Change as a Percent of BY 2004**
1	Letters	56.46%	67.92%	11.46%	20.30%
2	Flats	55.17%	67.70%	12.53%	22.71%
3	IPP/Parcel	45.20%	49.70%	4.50%	9.96%

Source: UPS-T1-Neels-WP-1/IOCS/IOCS Tally distribution by type.xls

As shown, increased compliance with the sampling rules has apparently resulted in a marked increase in direct tally percentages. Although direct tally percentages increased from Base Year 2004 to Base Year 2005 for all shapes, the increases for automated letters and flats (11.5 percentage points and 12.5 percentage points, respectively) were much greater than that for automated parcel operations (4.5 percentage points). In addition, in both years the direct tally percentages were much lower in absolute terms for parcels than in the corresponding operations for letters or flats. The difference in

[3] UPS/USPS-T46-2, Tr. 9/2359.

direct tally percentages between letters and parcels was 11.26 percentage points in 2004 but increased to 18.22 percentage points in 2005. For flats versus parcels, the corresponding difference was 9.97 percentage points in 2004 but 18 percentage points in 2005.

While the computerized prompts built into the new IOCS software were apparently effective where they were implemented – for automated letter and flats processing – it is unclear why a similar strategy was not implemented for automated parcel operations.

Mechanized sorting operations have assumed an increasingly important role in the processing of parcels. This trend will undoubtedly continue. While there may be differences between the operational environments surrounding mechanized parcel sorting operations and those surrounding mechanized letter and flats operations, all tend to separate staff from direct contact with the mail stream, and so all pose similar challenges for cost attribution. It is difficult to believe that the Postal Service cannot devise workable item selection rules that would incorporate automatic prompts for mechanized parcel operations similar to those for letters and flats.

Direct tallies are, of course, crucial to an accurate attribution of costs to products because they provide visibility into which subclasses are causing the costs. Failure to use a similar strategy for parcels could mean that the number of direct tallies is lower for the parcel stream than it should be. This distorts the attribution of the costs associated with parcels. Any change that increases the percentage of direct tallies also increases the accuracy of the product cost estimates based upon the IOCS data.

I urge the Postal Service to complete the work it has started in its update of the IOCS system, and to extend to the parcel stream the benefits of the more complete and accurate attribution of costs that it has achieved for letters and flats.

MAIL PROCESSING VARIABILITY

In separate testimony, Dr. Bozzo has updated his study of mail processing cost variability (USPS-T-12). While this latest study incorporates more recent data, it is based on the same conceptual framework used in the past. Not surprisingly, it has produced substantially the same results.

I have commented on this approach in the past,[4] and many of my past criticisms are equally relevant today. I conclude that it still cannot produce an accurate estimate of the volume variability of mail processing costs.

Significantly, as Table 2 shows, the Postal Service's study analyzes only about a third of the costs in Cost Segment 3.1, the Postal Service's largest cost segment.

Table 2

Percent of Mail Processing Costs Modeled by the Postal Service
($ in 000)

	R2001-1 BY2000 [a]	R2005-1 BY2004 [b]	R2006-1 BY2005 [c]
Total Mail Processing Costs	$14,993,198	$14,563,371	$15,085,044
Costs Econometrically Modeled	$ 5,255,141	$ 4,943,172	$ 5,081,417
Percent of Costs Modeled	35%	34%	34%

Sources:
[a] R2001-1, USPS-T-13, Table 1, Witness Van-Ty-Smith
[b] R2005-1, USPS-T-11, Table 1, Witness Van-Ty-Smith
[c] R2006-1, USPS-T-11, Table 1, Witness Van-Ty-Smith
UPS-T1-Neels-WP-1/ Other/Modeling of MP Costs/Modeling of Mail Processing Costs.xls

Nevertheless, the Postal Service recommends – without sufficient justification, in my view – that these results be extended to the remaining two-thirds of the costs that have not been studied.

[4] Docket No. R2000-1, UPS-T-1 (Tr. 27/12770-12849).

1. Background and Summary

In Docket No. R97-1, Dr. Bradley described his effort to derive a cost function relating mail processing labor hours to the number of "piece handlings."[5] The Commission rejected that study. In the next case (Docket No. R2000-1), Dr. Bozzo updated Dr. Bradley's work.[6] The updated study retained the principal features of Dr. Bradley's approach while attempting to address some of the criticisms made by other witnesses and by the Commission. The Commission rejected the updated study as well. The Postal Service again filed updated versions in Docket Nos. R2001-1 and R2005-1, but those cases were settled. As a result, these studies were not subjected to the same degree of critical scrutiny as in Docket No. R2000-1.

The current study still fails to rise to the level of conceptual, technical, and empirical quality required to justify abandonment of the Commission's long-established treatment of mail processing labor costs. Its approach is fundamentally the same as that used in Docket No. R97-1. While the Postal Service has changed some of the technical details, it has steadfastly refused to reconsider any aspect of its basic approach. It has done so despite the Commission's rejection of that approach and suggestions it has made as to the type of study it believes appropriate. As I testified in Docket No. R2000-1, the Postal Service's approach cannot provide a reliable and unbiased estimate of mail processing volume variability even if it were implemented perfectly.[7] And as I show, the implementation of the Postal Service's approach is far from perfect.

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[5] Docket No. R97-1, USPS-T-14, p. 13.

[6] Docket No. R2000-1, USPS-T-15.

[7] See Docket No. R2000-1, UPS-T-1.

The fundamental flaws, discussed in more detail below, may be summarized as follows:

(1) Unresolved questions of data quality. In Docket Nos. R97-1 and R2000-1, the Commission had significant concerns about the poor quality of the data upon which the analyses were based.[8] These data remain deeply flawed. Simple screens still label a surprisingly large portion of the data as suspicious or obviously erroneous. Many flawed observations find their way into the analysis. Efforts to apply stricter data quality standards substantively change variabilities and result in dramatically reduced samples whose representativeness is questionable.

(2) Narrow, fragmented view of mail processing operations. The study still divides mail processing into a series of narrowly defined operations and then analyzes each individually. By analyzing each activity in isolation, it largely ignores the fact that these operations are housed in the same facilities, are operated in many instances by the same personnel, and often serve as actual or potential substitutes for one another. The study ignores entirely the interactions among them and with other activities carried out simultaneously within the same plant. Statistical evidence indicates that this approach is incorrect.

(3) Excessively short-term view of volume variability. The Postal Service's analysis at best measures only the short-term response of costs to changes in volume. It ignores the manner in which the structure of the network evolves in response

[8] See Docket No. R97-1, Opinion and Recommended Decision, ¶¶ 3007-09, and Docket No. R2000-1, Opinion and Recommended Decision, ¶¶ 3025-28.

to volume growth. Specifically, the study measures variability while controlling for and implicitly holding constant many aspects of the structure of mail processing operations.

(4) Selection of inappropriate cost driver. The Postal Service improperly continues to rely on "piece handlings" as the cost driver. It asserts that the number of handlings a piece of mail undergoes is predetermined and constant, thereby implying a relationship of strict proportionality between piece handlings and true volume. The Postal Service largely ignores the fact that the structure of the mail processing network, and hence the number of handlings that a particular piece receives, changes over time in response to changes in the volume and the mix of mail moving through the system.

(5) Allocation of a majority of mail processing costs based on the study of a relatively small subset of activities. The Postal Service focuses on sorting operations in MODS plants, which account for only about a third of all mail processing costs. Despite substantial differences between the sorting costs studied and the remaining two-thirds of mail processing costs in terms of (a) the settings in which the costs are incurred and (b) the nature of the activities they support, the Postal Service argues that an average variability derived from sorting operations alone should be applied to all of the remaining unanalyzed mail processing costs.

2. Quality and Accuracy of the Data

> "The Government are very keen on amassing statistics – they collect them, add them, raise them to the *n*th power, take the cube root and prepare wonderful diagrams. But what you must never forget is that every one of those figures comes in the first instance from the village watchman, who just puts down what he damn pleases."[9]

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[9] Josiah Stamp, 1929 "Some Econometric Factors in Modern Life" pp. 258-59, quoted in Peter Kennedy's "A Guide to Econometrics" Fourth Edition, p. 140.

Since MODS data were first used for this purpose, the Commission and interested parties have expressed serious concerns over their quality and reliability. In both Docket Nos. R97-1 and R2000-1, I documented significant problems with these data.[10] Poor data quality appears to have played a significant role in the Commission's unwillingness to accept the Postal Service's estimates.[11]

As in the past, the Postal Service attempts to overcome the data quality problems through a series of screens or "scrubs" intended to eliminate questionable observations from the analysis. However, the "scrubs" eliminate thousands of observations, raising serious questions about the representativeness of the remaining data.

Given the longstanding nature of the data quality concerns, I am surprised at how little has been done to address them. Careful examination indicates that the data remain plagued by the same sorts of problems that existed in the initial study.

(a) The Misclocking Issue

One of the more significant sources of data error is "misclocking" – situations where an employee is working in one operation but records time in a different operation. When hours and their associated volumes are recorded in different MODS operations, analyses based on them are contaminated. It is also possible for sorting hours to be recorded in allied operations, which are not studied, and vice versa.

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[10] See Docket No. R97-1, UPS-T-1, pp. 15-34 (Tr. 28/15600-19); Docket No. R2000-1, UPS-T-1, pp. 24-30 (Tr. 27/12796-802)

[11] As stated in the Opinion and Recommended Decision in Docket No. R2000-1 at ¶ 3028,

> The Commission concludes that a substantial risk of "errors-in-variables" bias remains after witness Bozzo's data screens. As long as this risk remains substantial, the Postal Service's econometric estimates of variability cannot be regarded as reliable.

Such errors appear to be common. IOCS data provide some insight into the magnitude of this problem. The IOCS data collection process records information on the MODS operation a sampled worker is clocked into, and what the worker is actually doing. A significant number of IOCS tallies show that there is a mismatch between IOCS and MODS. The Commission has concluded that the IOCS data is more reliable than the MODS data.[12] As a result, in Docket No. R2000-1, $72.2 million of costs were transferred from Mail Processing to Window Service, and a surprising $537.6 million of costs were transferred from Mail Processing to Administration, based upon clocking errors disclosed by the IOCS data.[13] A similar adjustment may be necessary in this case.

This same data sheds light on the frequency with which a MODS worker is misclocked. Table 3 shows the results.

[12] Docket No. R2000-1, Opinion and Recommended Decision, ¶ 3015.

[13] Docket No. R2000-1, Opinion and Recommended Decision, ¶ 3007.

Table 3

Percent of IOCS Tallies for Which Worker Is Observed in Operation Other than Clocked Operation

What Worker is Observed to Be Doing (% of Clocked MODS Pool Dollar Tallies)

MODS Sorting Pool Into Which Worker is Clocked	Other MODS Sorting Activity or Cancellation	Non-Sorting Activity	Total
D/BCS	3%	11%	14%
OCR	21%	9%	30%
AFSM/100	6%	4%	10%
FSM/1000	9%	5%	14%
SPBS	5%	19%	24%
Manual Flats	7%	8%	15%
Manual Letters	5%	9%	14%
Manual Parcels	17%	32%	49%
Priority	13%	20%	33%
Cancellations	3%	46%	49%

Source: UPS-T1-Neels-WP-1/IOCS/Actual activity vs. clocked MODS.xls

Table 3 shows that significant portions of the hours charged to MODS sorting operations appear to be mis-categorized. The number of workers clocked into the wrong sorting operation is substantial. Clearly, this is a serious problem.

(b) Other Types of Errors in the MODS Data

MODS reports various measures. FHP ("first handling pieces"), TPF ("Total Pieces Fed"), and TPH ("Total Piece Handlings") are recorded separately for each MODS operation. FHP for an operation is the number of pieces of mail that are sorted for the first time at the plant in that operation.[14] TPF is the number of pieces fed into automated or mechanized equipment. TPH is the number of pieces sorted successfully.

[14] USPS-T-12, p. 23.

Thus, TPH equals TPF minus rejected pieces. Like TPF, TPH is generated for automated or mechanized operations by mechanical counters. For manual operations, TPH is measured in the same manner as FHP, i.e., by weighing batches of mail and applying conversion factors.[15]

As I have noted in the past, these measures necessarily imply the existence of certain logical relationships among them. In particular, by definition,

- For automated operations, "Total Pieces Fed" should always be equal to or greater than "Total Piece Handlings";
- For all operations, "Total Piece Handlings" should always be equal to or greater than "First Handling Pieces."

It is also necessarily true that

- If volume data are present, hours data should also be present, and vice versa;
- Neither the hours data nor any of the volume measures should have a negative value.

Violation of any of these relationships suggests that one of the data elements is incorrect. The data shows that these necessary relationships are often violated.

Other problems can also be identified from the "scrubs" used to eliminate erroneous observations. Based on discussions with operational experts, Dr. Bozzo identified for each operation its maximum and minimum productivity rates (i.e., pieces processed per labor hour).[16] He scrubs the data when the observed productivities fall

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[15] Docket No. R2000-1, USPS-T-15, p. 23.

[16] Docket No. R2000-1, USPS-T-15, pp. 110-12.

outside this range. In Docket No. R97-1, similar screens removed a set percentage of observations with the highest and lowest productivities.[17]

Dr. Bozzo's preferred productivity screening method is applied over each quarter taken as a whole. This approach may mask errors in the weekly and accounting period data from which his quarterly observations are constructed. In his new study, Dr. Bozzo investigates the effect of screening data at the weekly or accounting period level. Under this alternative approach, a quarterly observation is marked as questionable if data for one of its constituent weeks or accounting periods fails to pass the productivity screen. Because of masking, failure of this test can occur even for observations that pass tests conducted just at the quarterly level.

Dr. Bozzo also imposes a "threshold" test originally designed by Dr. Bradley to remove records with small numbers of piece handlings. Dr. Bradley assumed that these observations represented operations that were "ramping up."[18] In Docket No. R2000-1, Dr. Bozzo revised the justification for the threshold cutoffs, citing the need to eliminate "noise" from the data.[19]

Table 4 shows the frequency with which these various errors appear in the MODS data for automated operations in this case. The numbers in parentheses show the percentage of the potential sample with the indicated error.

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[17] Docket No. R2000-1, USPS-T-15, pp. 101-02.

[18] Docket No. R2000-1, USPS-T-15, p. 95.

[19] Docket No. R2000-1, USPS-T-15, p. 97.

Table 4

Data Errors for Automated Cost Pools

Line	Label	BCS Outgoing	BCS Incoming	OCR	FSM1000	AFSM100	Total SPBS
1	Total records in Analysis Dataset	10,304	10,304	10,304	10,304	10,304	10,304
2	Valid zeros: Count of records where operation was not present at plant, or plant was not reporting data to MODS system	1,521	1,250	2,335	3,902	6,045	4,207
3	Potentially Valid Records	8,783	9,054	7,969	6,402	4,259	6,097
4	Gaps in the data	141 (1.6%)	96 (1.1%)	1 (0.0%)	24 (0.4%)	12 (0.3%)	172 (2.8%)
5	HRS, TPF, FHP, or TPH < 0	512 (5.8%)	194 (2.1%)	44 (0.6%)	41 (0.6%)	8 (0.2%)	12 (0.2%)
6	HRS, TPF, or TPH = 0	1,178 (13.4%)	847 (9.4%)	180 (2.3%)	286 (4.5%)	132 (3.1%)	1,082 (17.7%)
7	Record fails Threshold or Productivity Screens at the quarterly level	257 (2.9%)	104 (1.1%)	189 (2.4%)	197 (3.1%)	578 (13.6%)	65 (1.1%)
8	TPH fails Threshold or Productivity Check at the AP or Weekly level	652 (7.4%)	336 (3.7%)	1,196 (15.0%)	780 (12.2%)	1,365 (32.0%)	228 (3.7%)
9	TPF fails Threshold or Productivity Check at the AP or Weekly level	726 (8.3%)	354 (3.9%)	1,120 (14.1%)	840 (13.1%)	1,469 (34.5%)	226 (3.7%)
10	FHP > TPH	1,946 (22.2%)	1,279 (14.1%)	3,063 (38.4%)	1,155 (18.0%)	1,529 (35.9%)	910 (14.9%)
11	FHP > TPF	1,252 (14.3%)	1,150 (12.7%)	1,110 (13.9%)	779 (12.2%)	882 (20.7%)	634 (10.4%)
12	TPH > TPF	16 (0.2%)	27 (0.3%)	3 (0.0%)	41 (0.6%)	67 (1.6%)	129 (2.1%)

Source: UPS-T1-Neels-WP-1/MODS Data/Data Errors/Output/Data Error Counts.xls

The table shows that data errors are widespread. Gaps in the data – instances where hours and volumes drop to zero for a time, only to resume later on – are common, especially for certain automated operations. Situations in which there are volumes but no hours, or hours but no volumes, or negative values for volume or hours, are also common.

When applied at the quarterly level, the threshold and productivity screens eliminate a relatively small portion of the sample for automated operations. However, when these same screens are applied at the weekly or accounting period level, a very different picture emerges: large portions of the sample include time periods with productivities that postal operational experts say are physically impossible. In the case of the AFSM100, roughly 30 percent of all observations fail the weekly or accounting period screens. Table 5 shows that the situation is even worse for manual operations.

Table 5

Data Errors for Manual Cost Pools

Line	Label	Manual Flats	Manual Letters	Manual Parcels	Manual Priority	Cancellations
1	Total records in Analysis Dataset	10,304	10,304	10,304	10,304	10,304
2	Valid zeros: Count of records where operation was not present at plant, or plant was not reporting data to MODS system	1,301	1,219	2,052	2,071	1,589
3	Potentially Valid Records	9,003	9,085	8,252	8,233	8,715
4	Gaps in the data	65 (0.7%)	32 (0.4%)	100 (1.2%)	203 (2.5%)	33 (0.4%)
5	HRS, FHP, or TPH < 0	16 (0.2%)	2 (0.0%)	5 (0.1%)	47 (0.6%)	5 (0.1%)
6	HRS or TPH = 0	120 (1.3%)	104 (1.1%)	1,310 (15.9%)	967 (11.7%)	212 (2.4%)
7	Record fails Threshold or Productivity Screens at the quarterly level	589 (6.5%)	176 (1.9%)	1,747 (21.2%)	1,145 (13.9%)	259 (3.0%)
8	TPH fails Threshold or Productivity Check at the AP or Weekly level	2,106 (23.4%)	971 (10.7%)	4,470 (54.2%)	3,500 (42.5%)	1,052 (12.1%)
9	FHP > TPH	32 (0.4%)	24 (0.3%)	41 (0.5%)	113 (1.4%)	0 (0.0%)

Source: UPS-T1-Neels-WP-1/MODS Data/Data Errors/Output/Data Error Counts.xls

Over half of the potential observations for the manual parcel operation include time periods whose reported productivities falls outside reasonable productivity bounds or fail the threshold screen. Over 40 percent of potential observations for the manual priority operation fail the same test. Even for the cleanest of the manual operations – manual letters – a full 10 percent of the potential observations fail this test.

(c) Effects of Data Errors on Potential Sample Sizes

The effect these errors have on the sample size depends on the numbers and kinds of errors one is willing to tolerate. The Postal Service has clearly made some

compromises in this regard. Even though the weekly and accounting period tests indicate that many of the quarterly observations – especially for manual operations – include time periods with obvious errors, they are nevertheless used in the analysis. Moreover, the BCS and MPBCS cost pools are reorganized in order to address "instability in the MPBCS data related to the gradual withdrawal of MPBCS equipment from service in favor of DBCS equipment."[20]

While "not all errors are equally important,"[21] it is nonetheless instructive to consider how much of the MODS data can truly be considered error-free. Tables 6 and 7 show the cumulative effects of the errors discussed above on potential sample sizes if one adopts a strict quality standard and considers only observations with no visible errors. They apply the tests shown on the left hand side sequentially, and show the number of usable observations remaining after each test is applied to the observations that pass all of the tests listed above it. Table 6 shows the cumulative effects of errors on the clean sample sizes available for automated operations. The numbers in parentheses show the percentage of the potential sample remaining. Table 7 shows a similar calculation for manual operations.

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[20] USPS-T-12, pp. 6-7.

[21] USPS-T-12, p. 65.

Table 6

Cumulative Effects of Data Error Screens on Automated Cost Pool Sample Size

Line No.	Screen Applied	BCS Outgoing	BCS Incoming	OCR	FSM1000	AFSM100	Total SPBS
		Observations Remaining After Each Screen					
1	Total records in Analysis Dataset	10,304	10,304	10,304	10,304	10,304	10,304
2	Valid zeros: Count of records where operation was not present at plant, or plant was not reporting data to MODS system	1,521	1,250	2,335	3,902	6,045	4,207
3	Potentially Valid Records	8,783 (100.0%)	9,054 (100.0%)	7,969 (100.0%)	6,402 (100.0%)	4,259 (100.0%)	6,097 (100.0%)
4	Gaps	8,642 (98.4%)	8,958 (98.9%)	7,968 (100.0%)	6,378 (99.6%)	4,247 (99.7%)	5,925 (97.2%)
5	HRS, TPF, FHP, or TPH < 0	8,130 (92.6%)	8,764 (96.8%)	7,924 (99.4%)	6,337 (99.0%)	4,239 (99.5%)	5,913 (97.0%)
6	HRS, TPF, or TPH = 0	7,041 (80.2%)	7,966 (88.0%)	7,772 (97.5%)	6,060 (94.7%)	4,110 (96.5%)	4,835 (79.3%)
7	Record fails Threshold or Productivity Screens at the quarterly level	6,886 (78.4%)	7,884 (87.1%)	7,602 (95.4%)	5,878 (91.8%)	3,550 (83.4%)	4,804 (78.8%)
8	TPH fails Threshold or Productivity Check at the AP or Weekly level	6,547 (74.5%)	7,664 (84.6%)	6,715 (84.3%)	5,493 (85.8%)	2,842 (66.7%)	4,691 (76.9%)
9	TPF fails Threshold or Productivity Check at the AP or Weekly level	6,476 (73.7%)	7,649 (84.5%)	6,510 (81.7%)	5,432 (84.8%)	2,708 (63.6%)	4,687 (76.9%)
10	FHP > TPH	4,971 (56.6%)	6,464 (71.4%)	4,127 (51.8%)	4,487 (70.1%)	1,849 (43.4%)	3,867 (63.4%)
11	FHP > TPF	4,971 (56.6%)	6,463 (71.4%)	4,127 (51.8%)	4,487 (70.1%)	1,848 (43.4%)	3,864 (63.4%)
12	TPH > TPF	4,966 (56.5%)	6,452 (71.3%)	4,127 (51.8%)	4,470 (69.8%)	1,831 (43.0%)	3,791 (62.2%)

Source: UPS-T1-Neels-WP-1/MODS Data/Data Errors/Output/Cum. Data Error Counts.xls

Table 7

Cumulative Effects of Data Error Screens on Manual Cost Pool Sample Size

Line	Screen Applied	Observations Remaining After Each Screen: Manual Flats	Manual Letters	Manual Parcels	Manual Priority	Cancellations
1	Total records in Analysis Dataset	10,304	10,304	10,304	10,304	10,304
2	Valid zeros: Count of records where operation was not present at plant, or plant was not reporting data to MODS system	1,301	1,219	2,052	2,071	1,589
3	Potentially Valid Records	9,003 (100.0%)	9,085 (100.0%)	8,252 (100.0%)	8,233 (100.0%)	8,715 (100.0%)
4	Gaps	8,938 (99.3%)	9,053 (99.6%)	8,152 (98.8%)	8,030 (97.5%)	8,682 (99.6%)
5	HRS, FHP, or TPH < 0	8,922 (99.1%)	9,051 (99.6%)	8,147 (98.7%)	7,983 (97.0%)	8,677 (99.6%)
6	HRS or TPH = 0	8,806 (97.8%)	8,947 (98.5%)	6,841 (82.9%)	7,028 (85.4%)	8,466 (97.1%)
7	Record fails Threshold or Productivity Screens at the quarterly level	8,231 (91.4%)	8,776 (96.6%)	5,138 (62.3%)	5,953 (72.3%)	8,259 (94.8%)
8	TPH fails Threshold or Productivity Check at the AP or Weekly level	6,821 (75.8%)	8,080 (88.9%)	3,663 (44.4%)	4,512 (54.8%)	7,624 (87.5%)
9	FHP > TPH	6,803 (75.6%)	8,060 (88.7%)	3,636 (44.1%)	4,447 (54.0%)	7,624 (87.5%)

Source: UPS-T1-Neels-WP-1/MODS Data/Data Errors/Output/Cum. Data Error Counts.xls

The percentage of the full potential sample that can be regarded as truly clean ranges from a low of 43 percent for the AFSM 100 cost pool to a high of 89 percent for Manual Letters.

(d) Effects of Imposing More Stringent Data Quality Criteria on Estimated Variabilities

As a sensitivity check on his results, Dr. Bozzo reestimates his variability models using a more restricted sample constructed by conducting the threshold and productivity screens at the pay period (AP) and weekly level. He reports that

> applying stricter screens has relatively little effect on most variabilities. Stricter screening does not serve to systematically increase or decrease the variabilities. The exception is that the IV models for manual parcels and manual Priority show increases in the point estimates but also rapidly increasing standard errors.[22]

This commentary and the reported results that accompany it obscure the full extent to which stricter data quality standards alter the results. Dr. Bozzo omits Manual Priority from the calculation of the composite variability when he reports that the variability generated from the more restricted sample (0.84) is quite similar to the recommended variability of 0.86.[23] However, there is no valid reason for excluding Manual Priority from this calculation. The imposition of stricter quality standards results in a more than 200 percent increase in the estimated variability for this operation. Furthermore, the tighter screens result in large changes in the values for OCR, AFSM100, manual parcels, and cancellations. The fact that some large decreases cancel out large increases obscures the fact that there is significant instability in many of the estimates.

In short, imposing stricter quality standards does in fact alter the results in a material way, as Table 8 shows.

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[22] USPS-T-12, p. 97.

[23] USPS-T-12, Table 26, p. 99.

Table 8

Changes in Variabilities Resulting from Stricter Quality Standards

Cost Pool	Recommended Variabilities -- Quarterly Screens	Weekly Level Screens	Percent Difference
BCS Outgoing	1.06	1.09	3%
BCS Incoming	0.82	0.81	-1%
OCR	0.78	0.68	-13%
FSM/1000	0.72	0.70	-3%
AFSM100	0.99	0.90	-9%
SPBS	0.87	0.84	-3%
Manual Flats	0.94	0.89	-5%
Manual Letters	0.89	0.87	-2%
Manual Parcels	0.80	0.97	21%
Manual Priority	0.75	2.28	204%
Cancellations	0.50	0.59	18%
True Composite	0.85	0.93	9%
Composite excluding Manual Priority	0.86	0.84	-2%

Source: USPS-T-12, Table 26.

Imposing stricter data quality standards also dramatically reduces the sample sizes.[24] As Table 9 shows, imposing stricter quality standards reduces the sample size by over 20 percent for five cost pools: BCS outgoing, OCR, AFSM100 (experiencing the largest reduction in sample size, 39 percent), Manual Parcels, and Manual Priority. As one would expect, the list of the cost pools with the largest reductions in sample size overlaps with the list of cost pools with the largest changes in variabilities.

[24] The sample sizes used to estimate the variabilities in Dr. Bozzo's Table 26 are not reported in his testimony, but they can be found in his TSP program output.

Table 9

Changes in Sample Size Resulting from Stricter Quality Standards

Cost Pool	Quarterly Screens [a]	Weekly Level Screen [b]	Percent Reduction
BCS Incoming	6,862	5,984	13%
BCS Outgoing	6,598	5,201	21%
OCR	5,991	4,560	24%
FSM/1000	4,322	3,631	16%
AFSM100	2,011	1,231	39%
SPBS	4,479	3,772	16%
Manual Flats	7,180	6,089	15%
Manual Letters	8,451	7,832	7%
Manual Parcels	4,846	3,445	29%
Manual Priority	5,520	4,177	24%
Cancellations	8,169	7,555	8%

Source
[a]: USPS-T-12, Tables 10,11,12 and 13
[b]: USPS-LR-L-56, Section 1 Alternative Runs TSP Programs

(e) Conclusion

The quality of the MODS data has not improved over time. The problems that were apparent in Docket No. R97-1 are equally apparent in this case. The Postal Service dismisses concerns over data quality, claiming that it has dealt effectively with this problem.[25] But the extent of the problems I have found raises serious concerns. One must wonder about the reliability of a data reporting system that produces obviously erroneous results up to 30, 40, or even as much as 50 percent of the time.

Moreover, these errors are substantively important. Stricter quality standards cause a material alteration in the estimated variability for a number of operations. Whether these changes result from the elimination of errors or from changes in the composition of the sample caused by a drastic reduction in sample size is unknown.

[25] USPS-T-12, p. 65.

3. Technical Flaws in the Postal Service's Analysis

The Postal Service has approached the problem of measuring the volume variability of mail processing costs in the wrong way. However, I also find evidence of significant technical problems even within the context of the methodology and conceptual approach it has chosen to use.

In this section, I examine three failings. First, the instruments the Postal Service uses to correct for the effects of measurement error in the volume data for manual operations are not adequate for this task. This is especially relevant because the use of instrumental variable techniques is one of the few methodological refinements reported in the Postal Service's new testimony. Second, the variability models do not pass standard tests of stability across subsamples. Among other tests, I consider whether the cost structure for a specific sorting operation is independent of the presence of a related operation – a key assumption of the Postal Service's approach. Finally, the magnitudes of the fixed effect coefficients generated by the variability models are not consistent with an interpretation that associates them with non-transitory productivity differentials.

(a) Problems With the Instrumental Variables

One of the more significant methodological developments in this line of work grew out of research conducted by Professor Mark J. Roberts of Pennsylvania State University on behalf of the Office of the Consumer Advocate.[26] Some parties had expressed concern over the possibility that measurement error in the volume data used as the cost driver may have been biasing downward variability estimates, especially for the manual processing pools. Dr. Roberts uses an instrumental variables estimation

[26] "An Economic Framework for Modeling Mail Processing Costs," Mark J. Roberts, March 2006.

technique, a well-recognized econometric methodology for achieving unbiased results in the presence of measurement error in regressors, to address this issue. Dr. Roberts' solution has been adopted in the most recent version of the Postal Service's mail processing analysis. The Postal Service's variability models for manual operations are all estimated using instrumental variables techniques.[27]

Measurement error in an explanatory variable can lead to bias because it creates a situation in which the measurement error is correlated with the error term in the regression, a serious violation of the assumptions underlying regression analysis. The solution depends upon identifying an appropriate set of "instruments" – a set of variables that are correlated with the regressor subject to measurement error, but uncorrelated with the error term of the regression. If a set of instruments does not meet these conditions, they cannot assure unbiased regression results. The full set of instruments used in an instrumental variables regression includes the explanatory variables that are believed to be free of error, as well as other variables not included in the regression that are believed to meet the conditions described above.

There are a number of tests to assess the suitability of a set of instruments. Tests of relevance measure the extent to which the chosen instruments are correlated with the regressor subject to measurement error. These tests can be understood in the context of a "first stage" regression in which one uses the full set of instruments – including both those that appear as explanatory variables in the main model, as well as the excluded instruments – to develop predicted values for the variable subject to

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[27] Dr. Bozzo uses TPH as the cost driver. Since he does not believe that TPH for automated operations is subject to measurement error, he does not use instrumental variables estimation for those variability models.

measurement error. To be relevant, the excluded instruments must add significantly to the explanatory power of this first stage regression. A joint F test of the significance of the coefficients for the excluded instruments can verify whether or not this condition is met. However, the excluded instruments must also make a non-trivial contribution to the overall explanatory power of the first stage regression.[28] If the excluded instruments provide little information that is not already contained in instruments that appear in the primary model, they will add little to that primary model.

Although these two conditions are related, they are not identical. If the sample size is sufficiently large, the excluded instruments may be judged to be statistically significant even though they make an insufficient contribution to the explanatory power of the first stage regression.

Finally, the instruments must be independent of the error term of the primary regression in order to adequately perform their intended job. If, for example, an instrument is drawn from a measurement process similar to that of the variable for which it is supposed to be an instrument and is thus subject to the same sorts of measurement error, its use will not correct the problem.[29] Whether or not a set of variables meets this validity condition can be tested by measuring the correlation between the error term from the first stage regression and that of the primary model.

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[28] Staiger, D and J. H. Stock "Instrumental Variables Regression with Weak Instruments." Econometrica 65(3): 557-86 (1997).

[29] One example of this would be the use in connection with a manual sorting operation of TPH as an instrument for FHP. Both variables would be measured by weighing the relevant portions of the mail stream and then applying the same conversion factor to arrive at estimates of piece counts. Thus, if FHP as estimated overstated true FHP, TPH as estimated would be likely to overstate true TPH as well.

I have calculated the test statistics described above for the Postal Service's instrumental variable regressions. Table 10 summarizes my results. They indicate that the instruments used in the Postal Service's manual operations models are not adequate. For manual letters, flats, parcels, and priority the instruments pass tests of validity and are also jointly significant in the first stage regression. However, they make only a small contribution to the explanatory power of that regression, and so they fail the second test of relevance. Therefore, it is doubtful that they are able to assure that the variability results for these operations are unbiased. The instruments for the cancellation operation also fail, although for a different reason; they pass both tests of relevance, but fail the test of validity.

Table 10

Results of Tests of the Reliability and Validity of Instruments Used in Manual Operation IV Estimation

	Manual Letters	Manual Flats	Manual Parcels	Manual Priority	Cancellations
Tests of Relevance					
F-test of Excluded Instruments	42.46	36.90	8.64	17.79	574.47
Interpretation	Jointly Significant	Jointly Significant	Jointly Significant	Jointly Significant	Jointly Significant
Partial R-squared of excluded instruments	0.0103	0.0106	0.0056	0.0101	0.1277
Interpretation	Insufficient. Bias Likely	Insufficient. Bias Likely	Insufficient. Bias Likely	Insufficient. Bias Likely	Sufficient
Test of Validity					
Anderson-Rubin Statistic	0.586	0.078	2.879	0.560	4.333
Interpretation	Valid instruments	Valid instruments	Valid instruments	Valid instruments	Non-valid instruments

Source: UPS-T1-Neels-WP-1/Analysis of USPS Models

In short, these results show that the Postal Service has not dealt with the effects of measurement error on its variabilities for manual operations.

(b) Instability of Regression Results across Subsamples

I have tested the stability of a number of the Postal Service's cost models by splitting the sample in various ways and re-estimating the model separately for each of the resulting subsets. I have then applied standard statistical tests to determine whether the cost behavior of the plants in the two subsamples can be explained adequately by a single parameter vector, or whether there are significant differences between the behavior of the two sets of plants. For the Postal Service's GLS fixed effects models, the relevant test is an F test of the null hypothesis that the non-fixed effects coefficients for the two subsamples are equal, against the alternative hypothesis that they differ. For the Postal Service's instrumental variable models, the relevant test is a likelihood ratio test of a similar hypothesis.

The results are somewhat surprising. In a large number of cases, the hypothesis that the Postal Service's model fits both portions of the sample is decisively rejected. I would have expected that the large number of parameters contained in the models would have been able to do a better job of capturing differences across subsamples and summarizing the relevant behavior. However, these results force me to conclude that there are many aspects of the cost behavior of these mail processing plants that are not encompassed by the models.

In conducting these tests, I have stratified the population of plants in a number of different ways. First, I contrast large and small plants. Then I contrast growing and stable plants. I also split the samples for a number of MODS operations based on

whether or not another MODS operation handling the same mail stream is simultaneously present. This latter stratification tests directly the Postal Service's argument that each sorting operation can be analyzed independently.

I first computed for each plant the average destinating RPW volume (summed across all shapes) over the period and divided the sample based upon whether the plant was above or below the median value. Note that for purposes of this analysis a plant is defined as either large or small for the entire sample period. This analysis thus compares two mutually exclusive sets of mail processing plants.

Table 11 shows the results for automated operations. The null hypothesis that the same set of coefficients applies to both sets of plants is decisively rejected in all cases.

Table 11

Results of Tests on Whether Large Plants Can Be Pooled With Small Plants for Automated Operations

Cost Pool	H0: Big Plants can be pooled with the rest	P-Value	Result
OCR	F(31, 5669) = 4.15	Prob > F = 0.0000	Reject HO
FSM1000	F(31, 4028) = 2.77	Prob > F = 0.0000	Reject HO
SPBS	F(31, 4218) = 3.00	Prob > F = 0.0000	Reject HO
BCS_IN	F(31, 6500) = 4.69	Prob > F = 0.0000	Reject HO
BCS_OUT	F(31, 6243) = 5.73	Prob > F = 0.0000	Reject HO

Source: UPS-T1-Neels-WP-1\Analysis of USPS Models\Chow Tests

Table 12 presents analogous results for manual operations. For the manual parcels and manual priority models, the null hypothesis of pooling cannot be rejected. However, it is decisively rejected for all of the other manual operations.

Table 12

Results of Tests on Whether Large Plants Can Be Pooled With Small Plants for Manual Operations

Cost Pool	H0: Big Plants can be pooled with the rest	P-Value	Result
MANUAL FLATS	chi2(16) = 53.75	Prob > chi2 = 0.0000	Reject HO
MANUAL LETTERS	chi2(13) = 46.50	Prob > chi2 = 0.0000	Reject HO
MANUAL PARCELS	chi2(14) = 16.82	Prob > chi2 = 0.2657	Cannot reject HO
MANUAL PRIORITY	chi2(14) = 12.26	Prob > chi2 = 0.5851	Cannot reject HO
CANCELLATION	chi2(14) = 132.81	Prob > chi2 = 0.0000	Reject HO

Source: UPS-T1-Neels-WP-1\Analysis of USPS Models\Chow Tests

Next, I have explored whether growing plants share the same cost structure as non-growing plants.[30] Table 13 shows the test results for automated operations.

Table 13

Results of Tests on Whether Growing Plants Can Be Pooled With Other Plants for Automated Operations

Cost Pool	H0: Growing Plants can be pooled with the rest	P-Value	Result
OCR	F(31, 5669) = 1.38	Prob > F = 0.0791	Cannot reject HO
FSM1000	F(31, 4028) = 1.54	Prob > F = 0.0292	Reject HO
SPBS	F(31, 4218) = 1.61	Prob > F = 0.0182	Reject HO
BCS_IN	F(31, 6500) = 2.13	Prob > F = 0.0003	Reject HO
BCS_OUT	F(31, 6243) = 2.99	Prob > F = 0.0000	Reject HO

Source: UPS-T1-Neels-WP-1\Analysis of USPS Models\Chow Tests

The null hypothesis that the same set of coefficients applies to both sets of plants is rejected for the FSM1000, the SPBS, and both the incoming and the outgoing BCS operations. For the OCR operation, the null hypothesis of pooling is rejected at the 10 percent level but not at the 5 percent level.

[30] To define growing plants, I run a simple regression of RPW volume on a time trend for each plant. If the coefficient on the time trend is positive and significant, that plant is treated as growing.

Table 14 presents analogous results for manual operations. The null hypothesis of pooling is decisively rejected in all cases.

Table 14

Results of Tests on Whether Growing Plants Can Be Pooled With Other Plants for Manual Operations

Cost Pool	H0: Growing Plants can be pooled with the rest	P-Value	Result
MANUAL FLATS	chi2(16) = 33.87	Prob > chi2 = 0.0057	Reject HO
MANUAL LETTERS	chi2(14) = 50.85	Prob > chi2 = 0.0000	Reject HO
MANUAL PARCELS	chi2(14) = 49.58	Prob > chi2 = 0.0000	Reject HO
MANUAL PRIORITY	chi2(14) = 38.94	Prob > chi2 = 0.0004	Reject HO
CANCELLATION	chi2(15) = 71.79	Prob > chi2 = 0.0000	Reject HO

Source: UPS-T1-Neels-WP-1\Analysis of USPS Models\Chow Tests

The Postal Service's analysis is based upon the crucial assumption that each of the various sorting operations can be analyzed independently, without regard to what else might be going on within the plants in which they are located. The results of my final set of tests call this key assumption into question. A large number of AFSM100 machines were installed during the period covered by the sample. To test whether these installations had effects on the other flats sorting operations, I have split the samples for the FSM100 and the Manual Flats cost models based on whether or not an AFSM100 was simultaneously present.[31] I have also split the Manual Parcels sample based upon whether or not an SPBS was simultaneously present.[32]

[31] The determination of whether or not an AFSM100 is present is based on whether or not the observation in question is part of the AFSM100 estimation sample.

[32] The determination of whether or not an SPBS is present is based on whether or not the observation in question is part of the SPBS estimation sample.

The results of these tests are shown in Table 15. In all three cases, the null hypothesis of pooling is decisively rejected. Therefore, one must conclude that, at least for these three operations, the cost behavior depends significantly on whether other operations share responsibility for the processing of the relevant mail stream. Thus, the central assumption that is critical to the Postal Service's whole approach – namely, that each MODS operations can be considered in isolation and independently of whatever else is going on around it – is not supported by the data.

Table 15

Results of Tests on Whether Plants With a Single Equipment Type Can Be Pooled With Plants with Multiple Equipment Types

Cost Pool	H0: AFSM100 present can be pooled with AFSM100 not present	P-Value	Result
FSM1000	F(32, 4027) = 3.70	Prob > F = 0.0000	Reject HO

Cost Pool	H0: AFSM100 present can be pooled with AFSM100 not present	P-Value	Result
Manual Flats	chi2(14) = 66.16	Prob > chi2 = 0.0000	Reject HO

Cost Pool	H0: SPBS present can be pooled with the SPBS not present	P-Value	Result
Manual Parcels	chi2(13) = 28.87	Prob > chi2 = 0.0068	Reject HO

Source: UPS-T1-Neels-WP-1\Analysis of USPS Models\Chow Tests

Dr. Bozzo reports the results of certain tests of cross-pool interactions.[33] He estimates several cost pool variability models in which he includes measures of volume from other MODS operations processing mail of similar shape, and reports the failure of these cross-pool interactions to achieve statistical significance. He concludes that these results confirm his separability assumption. Although these two sets of test results

[33] USPS-T-12, pp. 93-95.

appear to conflict, they actually measure different types of cross-pool interactions. Dr. Bozzo's test can only be applied when the interacting MODS operations are running simultaneously. I have considered whether the installation of an operation not previously present alters the cost structure of a related operation. Also, my tests allow the entire parameter vector to change when a new operation is installed; they are more general than those of Dr. Bozzo, encompassing a wider range of cross-pool interactions.[34]

(c) Implausibility of the Fixed Effects Results

All of the Postal Service's variability models include a set of fixed effects – parameters that allow the productivity of different mail processing plants to vary upward or downward by a multiplicative constant. Standard statistical tests decisively reject the null hypothesis that all mail processing plants share the same constant term and, by extension, a constant productivity level.

I have calculated the fixed effect coefficients produced by four of the Postal Service's variability models. Table 16 shows the highest and lowest productivity levels implied by fixed coefficient values for each of these cost pools. I have also calculated the ratio of productivities for the highest and lowest productivity plants.

[34] Time constraints have prevented me from conducting a comprehensive set of tests, and so I have not been able to measure the full extent of this web of cross-pool interactions.

Table 16

Productivity Differentials Implied by the Postal Service's Fixed Effects Models

Cost Pool	Min	Max	Implied Productivity Differential
OCR	0.532	2.980	560%
FSM1000	0.245	2.658	1084%
SPBS	0.284	2.048	722%
BCS_IN	0.397	2.528	636%
BCS_OUT	0.449	2.905	647%
MANUAL FLATS	0.541	3.425	633%
MANUAL LETTERS	0.421	2.119	503%
MANUAL PARCELS	0.233	3.743	1607%
MANUAL PRIORITY	0.443	2.821	637%
CANCELLATION	0.274	5.013	1828%

Source: UPS-T1-Neels-WP-1\Analysis of USPS Models\Fixed Effects\Table of Fixed Effects.xls

The results are startling. The most productive plant in the network is anywhere from 500 percent to 1800 percent more productive than the least productive plant, depending upon which cost pool one considers.

I do not believe that these coefficient values can be interpreted or defended as true measures of non-transient productivity differences between mail processing plants. The implied range of productivity differences is simply too large to be believed. I cannot imagine that one would observe a productivity differential of this magnitude between two groups of postal employees operating the same piece of equipment at two different locations within the United States. One would have to envision that in order to process the same volume of mail, it would be necessary to staff a sorting operation with five people in one location and 50 in another.

If these fixed effects are not measuring productivity, one must then ask what they *are* measuring. Frankly, I am unsure how to answer this question. I am inclined to

believe this implausible range of implied productivity differentials is instead a sign that something is deeply wrong with the models.

4. Volume-Related Changes in the Structure and Organization of Mail Processing Operations

Dr. Bozzo's discussions of mail processing activities emphasize their stability. He presents a set of diagrams depicting the organization of the various shape-based mail streams[35] and argues that similar pieces of mail always follow the same paths through the processing network. Although he emphasizes stability, he does not really say that the organization of mail flows is stable. Rather, he simply asserts that field managers are instructed to follow the operational plan for as long as it remains in force. This says nothing about how often the plan changes, or what circumstances or conditions prompt these changes.

In past testimony, I have documented the frequency with which major changes in the structure and organization of mail processing take place over the course of a rate cycle. I have also shown that these changes follow in the wake of volume growth.[36] In this section, I show that these findings continue to hold during the most recent period covered by the Postal Service's mail processing study. These findings are an important element of the response of mail processing costs to volume growth that is persistently ignored by the Postal Service.

A simple examination of the data indicates that substantial changes in the organization of mails flows do occur, and in fact have occurred over the time period

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[35] USPS-T-12, Figures 1 and 2, pp. 17 and 20.

[36] Docket No. R2000-1, UPS-T-1, pp. 5-18 (Tr. 27/12777-90).

covered by the data. Tables 17A-D classify MODS plants by the mix of sorting activities in place at various times.

Table 17A

Changes in the Mix of Letter Sorting Activities Present in MODS Plants

Activity Present?				Percent of Plants With Indicated Configuration						
DBCS	MPBCS	OCR	MLETTERS	1999	2000	2001	2002	2003	2004	2005
YES	YES	YES	YES	73%	75%	73%	71%	72%	71%	71%
YES	YES	NO	YES	6%	5%	5%	6%	7%	5%	5%
YES	YES	NO	NO			0%				0%
YES	NO	YES	YES	3%	3%	4%	5%	6%	6%	7%
YES	NO	YES	NO							0%
YES	NO	NO	YES	5%	3%	5%	5%	4%	5%	4%
YES	NO	NO	NO		0%	1%	1%	0%	1%	1%
NO	YES	YES	YES							
NO	YES	YES	NO							
NO	YES	NO	YES			0%	0%	0%	0%	0%
NO	YES	NO	NO							
NO	NO	YES	YES		0%			0%		
NO	NO	YES	NO						0%	0%
NO	NO	NO	YES	1%	0%			1%	1%	1%
NO	NO	NO	NO	11%	13%	12%	11%	11%	11%	11%
Total				100%	100%	100%	100%	100%	100%	100%

Table 17B

Changes in the Mix of Flats Sorting Activities Present in MODS Plants

Activity Present?			Percent of Plants With Indicated Configuration						
FSM1000	AFSM100	MFLATS	1999	2000	2001	2002	2003	2004	2005
YES	YES	YES		16%	41%	51%	49%	48%	46%
YES	YES	NO			1%	1%	1%	1%	1%
YES	NO	YES	55%	42%	19%	11%	15%	15%	16%
YES	NO	NO	1%	1%	1%	2%	2%	2%	2%
NO	YES	YES		0%	2%	10%	13%	15%	15%
NO	YES	NO			0%				1%
NO	NO	YES	32%	28%	25%	15%	11%	8%	9%
NO	NO	NO	12%	13%	12%	11%	10%	10%	9%
Total			100%	100%	100%	100%	100%	100%	100%

Table 17C

Changes in the Mix of Parcel Sorting Activities Present in MODS Plants

Activity Present?		Percent of Plants With Indicated Configuration						
SPBS	MPARCELS	1999	2000	2001	2002	2003	2004	2005
YES	YES	50%	51%	51%	50%	50%	52%	54%
YES	NO	7%	7%	10%	11%	12%	9%	9%
NO	YES	30%	27%	28%	29%	29%	28%	26%
NO	NO	13%	15%	12%	10%	10%	11%	11%
Total		100%	100%	100%	100%	100%	100%	100%

Table 17D

Changes in the Mix of Priority Mail Sorting Activities Present in MODS Plants

Activity Present?	Percent of Plants With Indicated Configuration						
MPRIORITY	1999	2000	2001	2002	2003	2004	2005
YES	77%	73%	79%	79%	79%	78%	76%
NO	23%	27%	21%	21%	21%	22%	24%
Total	100%	100%	100%	100%	100%	100%	100%

Sources and Notes:
UPS-T1-Neels-WP-1/MODS Data/Plant Activity Mix/Tables/WP Plant Activity Mix.xls
Note: Indicated activity is for fourth quarter values only.
Note: Visible zeros indicate a percentage greater than zero, but less than one.

While the mix of installed letter sorting activities appears to be relatively stable, the same cannot be said of flats sorting. Consider, for example, the AFSM100, equipment that occupies a prominent position in the flats sorting scheme shown in Dr. Bozzo's Figure 2. No such machines were installed as of the end of 1999, the first year for which Dr. Bozzo provides data. By the end of the period, however, AFSM100 machines were in operation in over half of all MODS plants. At the same time, the number of MODS plants relying solely on the manual processing of flats declined sharply, decreasing from 32 percent of all plants at the start of the period to a mere 9 percent by the end. There was also a slight increase in the number of plants running

mechanized parcel sorting operations, a trend I noted in my Docket No. R2000-1 testimony.[37]

Moreover, the MODS data fail to provide a full picture of the extent of the changes that have taken place. Significant equipment changes have been implemented within MODS pools. The testimony of Mr. McCrery is instructive. Some of the specific changes he describes– changes in the number of output sorting bins, for example – could be expected to alter the number of sorting schemes that have to be run, and thereby alter the ratio of setup time to run time within the cost pool. Mr. McCrery states that the Delivery Bar Code Sorter, the "automation workhorse," has undergone a number of modifications and changes to accommodate processing needs. These include the installation of additional stacker modules, wide field of view cameras, and the "ultimate DBSC retrofit," the DBSC Input/Output Subsystem Expanded Capability.[38] At the same time, the prior generation Mail Processing Bar Code Sorter was nearing the end of its useful life and being phased out.[39] All of these changes took place within the BCS cost pool during the period covered by the data.

There have also been changes in the geographic structure of the network during the sample period. Table 18 shows the number of MODS plants added to or removed from the network over the period covered by the data.

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[37] Docket No. R2000-1, UPS-T-1, Table 2, p. 10 (Tr. 27/12782).

[38] USPS-T-42, pp. 6-7.

[39] USPS-T-42, p. 8.

Table 18

Summary of Plant Reporting in MODS Dataset "vv9905.xls"

Year	Last Year: Total Plants	New Plants Reporting	Old Plants No Longer Reporting	Gross Change	Net Change	This Year: Total Plants
2000	329	8	9	17	-1	328
2001	328	14	2	16	12	340
2002	340	5	0	5	5	345
2003	345	2	1	3	1	346
2004	346	5	2	7	3	349
2005	349	2	4	6	-2	347
Total		**36**	**18**	**54**	**18**	

Source: UPS-T1-Neels-WP-1/MODS Data/Plant Reporting/tables/WP Summary of Plant Reporting-Yearly.xls

Over this period, 36 new plants were added to the network and another 18 plants ceased reporting. This is a substantial degree of change. Moreover, the changes shown in Table 18 will likely be dwarfed by changes occurring in the immediately upcoming years as a result of the Postal Service's Evolutionary Network Development ("END") initiative, which calls for a major restructuring of the mail processing network.[40]

As in my prior testimony, I continue to find that decisions regarding new equipment installations are strongly volume-related. Table 19 updates the analyses I presented in Docket No. R2000-1.[41] It shows the results of logistic regression analyses relating the presence or absence of selected automated mail processing operations to the volume of mail of the corresponding shape processed at the plant. Examining installations of FSM1000, AFSM100, and SPBS equipment, I find in all cases that these decisions are significantly related to volume.

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[40] PostCom, "Issue Brief: Evolutionary Network Design (END)," July 2006, p. 5.

[41] Docket No. R2000-1, UPS-T-1, pp. 15-16 (Tr. 27/12787-88).

Table 19

Binary Logit Results on Presence of Equipment Type

Dependent variable=1 if the Facility has FSM1000 Equipment

	Coef	Standard Error	Z	P-value
Log of Flats TPH	1.26	0.08	15.22	0.00
Constant	-9.71	0.74	-13.15	0.00
N	7350			

Dependent variable=1 if the Facility has AFSM100 Equipment

	Coef	Standard Error	Z	P-value
Log of Flats TPH	5.79	0.10	58.16	0.00
Constant	-55.76	0.96	-57.82	0.00
N	7350			

Dependent variable=1 if the Facility has SPBS Equipment

	Coef	Standard Error	Z	P-value
Log of Parcels TPH	4.88	0.25	19.50	0.00
Constant	-32.70	1.70	-19.20	0.00
N	5115			

Source: UPS-T1-Neels-WP-1/Logit Models

5. Implications for the Use of Piece Handlings as a Cost Driver

The Postal Service's updated analysis continues to rely on piece handlings as the cost driver. I challenged this assumption both in Docket No. R97-1 and in Docket No. R2000-1, and I continue to believe that piece handlings do not represent the appropriate cost driver.

I recognize that the mail processing environment has changed considerably since the first mail processing variability study was introduced in Docket No. R97-1. Our understanding of mail processing has evolved considerably since then. Thus, a fresh discussion of the reasons for rejecting piece handlings as a cost driver may be helpful.

(a) The Proportionality Assumption

As I have previously argued, the validity of the use of piece handlings as a cost driver depends upon the validity of the assumption that piece handlings vary directly with volume. This assumption has been called the "proportionality assumption."[42] Although Dr. Bozzo has in the past challenged my view,[43] he seems in this case to concede that the "Volume Variability/Distribution Key Method" assumes a relationship of direct proportionality between the cost driver and mail volume.[44] He offers an extensive discussion of the relationship between TPH and FHP, the essential conclusion of which is that within any given operational plan, these two measures will be directly proportional.[45] The crux of his argument is the assertion that "identical pieces will follow the identical (expected) paths through the sorting network under the operational plan."[46]

Although these arguments appear to be well-informed and generally plausible, they are subject to two important qualifications, both of which are implied in the passage quoted above. First, while identical pieces should follow the same *expected* path, they do not necessarily follow the same *actual* path. Second, and more important, this consistency is expected only within the confines of a single operational plan. If the operational plan changes, one would generally expect routings to change as well.

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42 See Docket No. R2000-1, UPS-T-1, pp. 30-33 (Tr. 27/12802-06).

43 In his Docket No. R2000-1 testimony, for example, Dr. Bozzo asserted that there is "no inherent bias in the proportionality assumption." USPS-T-15, p. 53.

44 See USPS-T-12, p. 106. He argues that in the absence of proportionality, the method still works to "a first order approximation."

45 USPS-T-12, pp. 35-39.

46 USPS-T-12, p. 39.

How frequently do actual processing procedures deviate from those called for in the plan? One would expect that an organization running an operation as complex as the Postal Service under changing and unpredictable conditions would routinely encounter disruptions, breakdowns, or other unexpected events that necessitate deviations from normal operational procedures. Indeed, operational witnesses for the Postal Service have confirmed that such deviations do in fact occur. Mr. McCrery testifies, "Occasionally when flats sorting equipment is at full capacity some flat mail must be processed in manual operations in order to ensure that service standards are met."[47] This confirms points made in prior testimony on the use of manual operations as a backstop to automated processing, and on the extraordinary efforts the Postal Service makes to assure that service standards are met even if extra costs are incurred in the process. While such departures from standard operating procedure may be the exception rather than the rule, they do occur, and they influence costs with an unknown frequency. Equally unknown is how the frequency of such deviations relates to the volume of mail being processed, or the magnitude of their effect on the relationship between piece handlings and volume.

(b) The Relationship between Volume and Change in the Structure of Mail Processing

The second implied qualification – that identical pieces can be expected to be processed in identical ways only within the confines of the same operational plan – is the more significant one.

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[47] USPS-T-42, p. 19.

Although the Postal Service emphasizes the fixed nature of its operational plan and the fact that it is predetermined with respect to any specific piece of mail, it is clear that the structure of the Postal Service's mail processing operations has undergone substantial change in recent years, and it can be expected to undergo even more drastic change in the future. It is also clear that the location, timing, and frequency of these changes are volume-related. Such changes in structure are part of the Postal Service's response to changes in volume, and should be accounted for in assessing the relationship between costs and volume.

Changes in the structure of mail processing influence the relationship between costs and volume in a number of different ways. First, average cost per piece changes because of volume-related shifts in the mix of sorting activities.

Second, a reorganization of mail flows might change the number of handlings that a particular piece of mail receives. Whether such a change raises or lowers handlings per piece is unclear. When manual letter sorting was replaced first by a combination of manual sorting and BCS, and then by a combination of manual, BCS, and OCR operations, it was reasonable to expect handlings per piece to increase. With the installation of multifunction sorters with scanner and optical character recognition capabilities, the direction of change is less clear. One cannot simply assume such changes away, however. Changes in activity mix can be expected to cause discontinuous shifts in the relationship between piece handlings and volume.

Finally, there are costs directly associated with change that should be attributed to the volume growth triggering the change. Both Dr. Bradley and Dr. Bozzo used a "threshold" screen designed to exclude from their analyses time periods during which a

new sorting operation is ramping up to full operational status. They argued that the relationships between cost and volume observed during these startup periods are not typical of what one would expect when the operation is up and running. While true, this argument ignores the fact that startup costs incurred during a regime change that is triggered by volume growth are part of the costs that need to be accounted for in a full and proper analysis of volume variability.

The Postal Service's approach assumes away all change. Dr. Bozzo's models relate labor hours to piece handlings within a narrowly defined sorting operation viewed in isolation, and only when it is fully up and running. That approach might be appropriate in a world where the operational plan never changes. The Postal Service has never operated in such a world, however. The inability of its approach to accommodate change and the associated costs is a fatal flaw.

(c) Accounting for Presort Volumes

A stronger argument for using piece handlings as a cost driver relates to the need to account for the growing tendency of mailers to take advantage of presort discounts. Increased use of presorting can be expected to influence the relationship between volume and mail processing costs and should be properly accounted for. Dr. Bozzo argues that by using piece handlings as the cost driver, he has appropriately netted out the effects of shifts in the mix of presorted and non-presorted mail.

However, this argument is valid only to the extent that other aspects of the relationship between piece handlings and volume have been properly accounted for, such that presorting effects can be properly netted out. As I have argued, Dr. Bozzo systematically ignores the costs and consequences of changes in the organization of

the mail processing network. Therefore, I do not believe that he can validly claim to have fully accounted for the effects of presorting on costs.

(d) The Lack of Relevance of Piece Handlings to Non-Sorting Costs

One of the most critical problems associated with using piece handlings as the cost driver – and one which likely will become more severe over time – is its lack of relevance to the two-thirds of mail processing costs incurred outside of sorting operations. Piece handlings are, by definition, measures of activity within sorting operations. As noted above, however, a large majority of mail processing costs are incurred outside of these activities, in allied and overhead operations. Moreover, the fraction of costs accounted for in sorting operations seems destined to decline further over time as mailers take over a greater and greater fraction of the responsibility for sorting.

Dr. Bozzo recommends that the composite variability he derives from the results of his analyses of sorting operations should be applied to the substantial mail processing costs that he has not explicitly considered.[48] This recommendation is supported by assertions that the nature of the work performed in the two sets of operations is similar – assertions that are supported by little specific evidence.[49] Dr. Bozzo also argues that the volumes moving through the sorting operations are the ultimate drivers of the workload in other non-sorting MODS operations.[50] This may have been true in the past, but in a world characterized by increasing mailer presorting, it is becoming less and less true.

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[48] USPS-T-12, pp. 83-84.

[49] USPS-T-12, p. 83.

[50] USPS-T-12, p. 84.

The only real way to understand the volume variability of the unexamined mail processing operations is to relate their costs to the true volume of mail moving through the plant. Even presorted mail can generate costs as it moves through a plant, and a well-crafted variability model should account for its presence. I have long argued that we need to examine the relationship between mail processing costs and actual mail volumes. The growing importance of allied and overhead operations underscores this need.

6. New Evidence on Mail Processing Cost Variability

I have attempted within the constraints of the available data to estimate a mail processing cost variability model that addresses and overcomes the shortcomings in the Postal Service's work. This model and the approach upon which it is based differ from the Postal Service's in a number of important respects.

First, I have used labor hours at the plant level as the dependent variable for this analysis. Given the available information, this required summing hours across the various sorting operations examined by Dr. Bozzo.[51] A plant level approach offers a number of important advantages:

- **It captures a wide range of possible cross-operation interactions.** The split sample results reported above indicate that, contrary to the Postal Service's assumptions, the cost structure in a sorting operation is influenced by the presence of other operations around it. I have long suspected that such cross-operation interactions may take place not just within a shape stream, but also

[51] I requested data from the Postal Service that would have permitted me to include not just sorting operation hours, but also hours logged in allied and overhead operations. However, the Postal Service objected to this request. See Objection of United States Postal Service to Interrogatories of United Parcel Service to Witness Bozzo (USPS-T-12): UPS/USPS-T-12-48 and 49 (August 18, 2006). I was surprised by this response. Because I was requesting information at a much higher level of aggregation, I had assumed that it would have been much easier to assemble than that which Dr. Bozzo used.

across shape streams. Adoption of a plant level approach makes it possible to account for such interactions.

- **It appropriately treats changes in activity mix as an endogenous response to volume changes.** Examination of costs at the plant level permits measurement of the full response of labor hours to volume changes, including hours related to volume-driven changes in the mix of operations present.

- **It provides a conceptually sound framework into which allied and overhead operations can be integrated.** Had labor hours for these operations been available, it would have been easy to include them in the analysis.

- **It facilitates some degree of netting out of clocking and logging errors.** To the extent that some portion of the data errors documented above arise because hours or volumes have been assigned to the wrong MODS operation, a plant level analysis allows these errors to cancel out.

Second, I have used first handling pieces, or FHP, as the cost driver. This approach eliminates concerns over whether and to what extent piece handlings vary in direct proportion to volume, and it appropriately treats shifts in the TPH/FHP ratio attributable to volume-related changes in the structure of operations as endogenous to the model. The models whose results are discussed below include as explanatory variables three measures of volume: FHP for letters, flats, and parcels. Because the Manual Priority volume could potentially include multiple shapes, I have used the IOCS data estimate of the shares of the stream accounted for by letter, flat and parcel shapes. Using these fractions, I have allocated the Manual Priority FHP volumes by shape.

Third, I have based my model on a simplified version of Dr. Bozzo's specification. Over the years, the number of explanatory variables included in the Postal Service's variability models has grown considerably. In some cases (for example, capital stock), he controls for factors that I would regard as endogenous to the model. In others (for example, wage rates), the variables appear to lack significance or play little substantive role in the analysis. In the interest of simplifying the exposition and limiting the

deleterious effects of isolated missing values on the size of the available sample, I have omitted many of them from my analysis. In addition to the volume variables described above, I include the number of delivery points in the plant's service area and a time trend. I have not explored whether the inclusion of any of the other variables in the Postal Service's model would alter my results in a material way.

Finally, I have adhered to strict standards of data quality. I include in my analysis only observations that are free from visible error. Because this resulted in a dramatic reduction in sample size, I also replicate my analysis on an alternative sample that adheres to looser data quality standards. In particular, in this alternative sample, I ignore instances in which data at the weekly or accounting period levels fail to pass one of Dr. Bozzo's productivity or threshold screens.

In both of these alternative samples, I use only data for each of the individual MODS operations that meet the relevant quality standard. It is this requirement that data for *all* of the MODS operations be accurate that appears to account for the substantial reductions in sample sizes that I experience. I have sought to include in the analysis sample all otherwise acceptable observations for which one or more MODS operations are truly absent. In other words, I have tried to accept true zero values as valid data, while omitting observations that fall in a gap in the series for one or more operations. The attribution of the sample to the final sample size as a result of applying these screens is shown in Table 20.

Table 20

Sample Size Attribution for Plant Level Models

Line No.	Description	Flats	Letters	Parcels	Priority	Cancellations
1	Potentially Valid Records	10,304	10,304	10,304	10,304	10,304
2	Gaps	10,203	10,110	10,035	10,101	10,271
3	HRS, TPF, FHP, or TPH < 0	10,138	9,390	10,018	10,054	10,266
4	HRS, TPF, or TPH = 0	9,638	7,729	7,906	9,099	10,055
5	Record fails Threshold or Productivity Screens at the quarterly level	8,461	7,380	6,316	8,024	9,848
6	TPH fails Threshold or Productivity Check at the AP or Weekly level	6,457	6,298	4,960	6,583	9,213

		Strict Sample	Loose Sample
7	Records that are valid across all shapes	1,978	3,297
8	Records for plants not in operation	816	816
9	Records with no missing variables	1,162	2,481
10	Records for plants with more than one record (final sample size)	920	2,155

Source: UPS-T1-Neels-WP-1/MODS Data/Data Errors/output/Analysis Sample.xls

To deal with the problem of measurement error in the volume variables, I have used an IV fixed effects estimation method. For instruments I use RPW volumes by shape, and TPH counts by shape. In both samples, these instruments pass tests of relevance and validity. Because of the difficulty of implementing the instrumental variables estimator for the translog, I have used a log-linear rather than a linear form.

The final stage estimation results for the two samples are presented in Tables 21 and 22. In all cases, the coefficients on volume are positive and significant.

Table 21

Plant Level Model Estimation Results Based on Strict Sample Flags

	Coef	Standard Error	z	P-value
Log of FHP LETTERS	0.98	0.07	14.57	0.00
Log of FHP FLATS	0.10	0.01	12.31	0.00
Log of FHP PARCELS	0.06	0.02	3.96	0.00
Time Trend	-0.01	0.00	-10.92	0.00
Log of Delivery Points	-0.61	0.32	-1.90	0.06
N	920			

Source: UPS-T1-Neels-WP-1/Plant Level Model

Table 22

Plant Level Model Estimation Results Based on Looser Sample Flags

	Coef	Standard Error	Z	P-value
Log of FHP LETTERS	0.88	0.04	22.01	0.00
Log of FHP FLATS	0.09	0.01	17.52	0.00
Log of FHP PARCELS	0.06	0.01	4.62	0.00
Time Trend	-0.02	0.00	-27.30	0.00
Log of Delivery Points	-0.17	0.14	-1.20	0.23
N	2155			

Source: UPS-T1-Neels-WP-1/Plant Level Model

The use of strict quality standards results in a usable sample size of 920 observations. The looser standards permit a sample size of 2,155. These dramatic reductions from the potential sample of more than 10,000 observations are a stark reminder of the extent of the errors in the MODS data.

Table 23 shows the resulting volume variabilities. I have calculated these variabilities by summing the estimated volume coefficients, which is equivalent to assuming that the shape mix will remain constant as volume grows.

Table 23

Variabilities Resulting from Plant Level Model

	Variabilities	Std. Error	z	P>|z|	[95% Conf. Interval]
Strict Sample	1.14	0.06	17.84	0.00	(1.01, 1.26)
Looser Sample	1.03	0.04	27.46	0.00	(0.96, 1.10)

Source: UPS-T1-Neels-WP-1/Plant Level Model

The point estimate for volume variability implied by the model based upon the strict sample is 114 percent. The 95 percent confidence interval for this estimate almost touches 100 percent at its lower bound. The volume variability point estimate produced by the looser sample is 103 percent. The 100 percent value falls well within the 95 percent confidence interval around this estimate.

I am not prepared to argue that the Commission should adopt these estimates as definitive. Given the known problems with the MODS data and the dramatic loss in sample size caused by the strict quality screening procedures used, it is difficult to guarantee that the final estimation samples are representative of the larger population from which they are derived. Moreover, because these results are based on the data used by the Postal Service, they are relevant only for the subset of costs that Dr. Bozzo has explicitly modeled. These results do suggest, however, that the use of stricter quality standards and the adoption of a broader view of how growth in volume can influence the structure and costs of mail processing tend to produce higher estimates of volume variability, ones that approach 100 percent.

More importantly, I believe that these results provide an important indication of what an appropriately designed analysis of mail processing variability should look like. They suggest the direction that future research on this subject should take.

7. Conclusion

While the mail processing study introduced by the Postal Service incorporates new data and selected methodological refinements, it is, fundamentally, simply an updated version of the same study that has been rejected by the Commission in Docket Nos. R2000-1, R2001-1, and R2005-1. Many of the criticisms made in Docket No. R2000-1, the last fully-litigated rate case, remain equally relevant today. I continue to believe this study, even in its present incarnation, is fundamentally flawed. I urge the Commission to reject it for the following reasons, discussed in detail above:

- The MODS data upon which the study is based remain error-ridden, and the reliability of this data source has not improved over time. I recognize that Dr. Bozzo remains dismissive of such concerns, and that he claims to have struck the right balance between retaining erroneous data in his analysis and eliminating so many observations that his results become biased and inconsistent.[52] I question, however, whether such a balance really exists. Dr. Bozzo's own results suggest that if one imposes different data quality screens, one gets noticeably different results. The results of the plant level analysis I present confirm this dependency. It is hard to tell which set of results provides the right answer, given the possibility on the one hand of bias due to measurement error and outliers, and, on the other hand, bias due to sample truncation. Data quality remains a serious concern. Rarely have I worked with a dataset containing so many obvious errors.

[52] See USPS-T-12, pp. 64-65.

- The Postal Service's study continues to ignore entirely all of the issues relating to changes in the structure of mail processing, the connection between such changes and changes in volume, and the question of how to assure that the costs associated with such changes are appropriately factored into estimates of the volume variability of mail processing costs. In the world analyzed by the Postal Service, MODS sorting operations are always up and running, the operational plan is always fixed, and the only question is how many pieces are run through the system from one quarter to the next. This is not the world in which the Postal Service actually operates.
- The Postal Service's study continues to adopt a narrow, fragmented view of cost causation in which each operation is analyzed in isolation and no operation is influenced in any manner by what is going on around it. The Postal Service's unshakable commitment to this point of view necessarily leaves it with an excessively short term view of cost causation, an inability to deal realistically with structural changes, and a blindness to many issues such as congestion, staffing constraints, or spillover effects that only become visible when the system is viewed holistically. I have found evidence suggesting that the presence or absence of related MODS sorting operations affects a separate operation's cost structure. The question of how these operations, housed together within the same mail processing plant, interact with each other deserves far more attention than it has received.
- Finally, the Postal Service's study does not address in any way the two-thirds of mail processing costs that fall outside of direct sorting operations. Their cost

structure and volume variability remain unexplored, and they are likely to grow in importance.

I have presented alternative estimates of volume variability based upon more careful screening for errors and a plant-level approach that captures shifts in activity mix and interactions between different activities and mailstreams. These preliminary results are consistent with the Commission's established position that mail processing costs are 100 percent volume variable. The methodology they are based upon can be readily adapted to address the two-thirds of mail processing costs that have not been studied in the last four rate cases.

FEDERAL EXPRESS AIR TRANSPORTATION COSTS

1. Background

Since Docket No. R2000-1, the Postal Service's purchased air transportation network has changed significantly. At that time, contractors working for the Postal Service operated the dedicated overnight Eagle and Western air networks, ostensibly for the purpose of assuring that Express Mail met its service standards. These networks also carried significant volumes of First Class Mail and Priority Mail. For the transport of Priority Mail, First Class Mail, and other categories of mail, the Postal Service relied heavily on daytime transportation provided by scheduled passenger air carriers.

The passenger air carriers charged the Postal Service a flat per-unit rate for daytime air transportation. The resulting costs were treated as 100 percent volume variable. Non-Express Mail moving on the Eagle or Western networks was assigned the same cost that it would have incurred had it traveled on passenger air carriers on the theory that if spare capacity had not been available on these dedicated networks, then

the standard scheduled air passenger costs would have actually been incurred. Costs charged in this way to non-Express Mail products were deducted from total Eagle and Western network costs, and the remainder was treated as a product-specific cost attributable only to Express Mail.[53]

In 2001, the Postal Service entered into a broad, multifaceted seven-year agreement with Federal Express. Under the terms of this agreement, the Postal Service began to obtain a major portion of its required lift from Federal Express. The Postal Service paid a fixed per-unit fee for every item handled and scanned by Federal Express. It also paid a fuel charge and a non-fuel transport charge that were levied on a per-cubic-foot of capacity purchased basis. Because the amount charged varied directly with usage, these charges were regarded as 100 percent volume variable.[54]

Following 9/11 and the subsequent decision by the Federal Aviation Administration to limit mail that could be carried in passenger aircraft, the Postal Service significantly increased its reliance on Federal Express for the transportation of time-sensitive mail and the flat rate structure for non-fuel transport charges in the original contract was replaced with a declining block rate structure under which the rate paid falls as the volume of mail transported increases.[55] However, there is still an additional charge for every additional cubic foot of mail transported.[56]

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[53] See generally Docket No. R2000-1, Opinion and Recommended Decision, ¶¶ 3304-13. In Docket No. R2000-1, I challenged this treatment, arguing that a larger portion of these costs should have been attributed to Priority Mail.

[54] USPS-T-15, p. 2.

[55] USPS-T-15, pp. 2-3.

[56] Tr. 13/3828.

In Docket No. R2005-1, Dr. Bradley presented testimony addressing the question of how to calculate the volume variability of costs incurred under a declining block rate structure. Dr. Bradley concluded that under these circumstances the volume variability of these costs would be less than 100 percent.[57]

These changes were highlighted by the Commission in its Opinion and Recommended Decision in the unlitigated R2005-1 rate case:

> The Commission's estimate of purchased air transportation costs has not incorporated the Postal Service's proposal to base attribution of these costs on the declining block rate structure introduced into the FedEx contract. . . . There is . . . a significant unlitigated issue as to how to properly treat the remaining 25 percent of purchased air transportation costs that are not estimated to be volume variable. The Postal Service proposes that these costs be treated as institutional. Priority Mail and First-Class Mail, however, are the only subclasses of mail with significant volumes transported under the Day-Turn portion of the FedEx contract, and it appears that the contract exists for the purpose of transporting those two classes.[58]

Based on Dr. Bradley's analysis and the structure of the payment schedule in the Federal Express contract, Postal Service witness John P. Kelley concludes in this case that the Base Year volume variability of the non-fuel transport costs associated with the Day-Turn network ranges from 72.29 percent to 75.83 percent, depending on the quarter.[59] If accepted, this drop in volume variability would create a pool of "non-volume-variable" costs that did not exist before. It raises the question of how to treat these non-variable costs.

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[57] Docket No. R2005-1, USPS-T-31, p. 15.

[58] Docket No. R2005-1, Opinion and Recommended Decision, ¶ 4094.

[59] USPS-T-15, p. 4.

2. How Should the Federal Express Day-Turn Network Costs Be Treated?

The Commission's observations in Docket No. R2005-1 highlight two issues that deserve special scrutiny. The first is that the Postal Service is arguing for a significant change in volume variability based solely upon the use of a declining block rate structure in the contract between the Postal Service and Federal Express. The second is that while the substantial non-volume variable portion of these costs is, as the Postal Service agrees, caused by just two products, those costs are paid for by all products as part of their share of total institutional costs.

On the first point, I cannot dispute Dr. Bradley's algebra. The formula for the elasticity of costs with respect to volume can be shown to be equal to the ratio of marginal cost to average cost. As long as volumes reach beyond the initial block, the use of this formula in the context of a declining block rate structure inevitably results in a ratio that will be less than one. If the Commission accepts this situation at face value, the conclusion that volume variability is less than 100 percent follows mathematically. However, this situation is somewhat unusual.

The decline in volume variability argued for by the Postal Service results solely from an addendum to a contract between a supplier and the Postal Service. Apparently, Federal Express did not initially offer a declining block rate structure. Rather, the Postal Service requested a volume discount from Federal Express.[60] The Postal Service argues that when Federal Express chose to comply with this request, the cost structure

[60] Institutional response to UPS/USPS-T-15-4.

of the Postal Service changed at the stroke of a pen, creating a new pool of non-volume variable costs.[61]

As the Commission's Opinion and Recommended Decision in Docket No. R2005-1 indicates, the Postal Service argued in that case that the non-volume variable portion of the Federal Express Day-Turn Network cost is an institutional cost. In other words, the Postal Service argued that these costs should be regarded simply as part of the overall cost of the network that should be paid for jointly by the contribution margin generated on all of the Postal Service's products.

Nevertheless, the Postal Service has clearly stated in this case that these costs are caused by Priority Mail and First Class Mail.[62] Yet, it still refers to them as institutional costs.[63] In short, these costs go into the institutional cost pool and are therefore paid for by all classes of mail, even though the Postal Service agrees that they are caused solely by Priority Mail and First Class Mail.

These costs should clearly be included in the baseline attributable costs of Priority Mail and First Class Mail to which the appropriate class-specific markups are applied. In this instance, a case can be made for allocating these costs solely between Priority Mail and First Class Mail on the basis of volume: Mr. Pajunas has testified that the Day-Turn network was sized for Priority Mail and First Class Mail, with 75% of the

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61 The Postal Service and Federal Express recently entered into another addendum to the contract. It apparently also has a declining block rate structure, but the details of changes in the contract have not been made part of the record.

62 USPS-T-14, p. 7.

63 Id.

capacity allocated to Priority Mail and 25% allocated to First Class Mail.[64] The contract under which these costs are incurred establishes a schedule of rates expressed on a per cubic-foot of capacity basis.[65] The Postal Service has stated that the two classes enjoy equal priority of access to the network.[66] It would not be unreasonable, therefore, to assume in the absence of better data that the relative volumes of Priority Mail and First Class Mail on the Day-Turn Network (expressed on a cubic foot basis) are constant over the entire range of volumes transported.[67] Under these conditions, the relative costs associated with these two mail classes would be proportional to their relative volumes in cubic feet.

Dividing such costs solely between the products on whose behalf they are incurred provides the best way of assuring that these costs are paid for by the users of those products and no others. Such a division makes it possible to include these costs in the costs directly attributable to these products and guarantees that they are fully reflected in the rates charged for them.

Alternatively, in Docket No. R2005-1, the Commission apparently did not have sufficient information to determine whether the Postal Service's proposed treatment truly reflected new circumstances or not. In the absence of additional information in this

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64 USPS-T-45, p. 1. In FY 2005, Priority Mail and First Class Mail represented approximately 94% of the cubic feet of mail transported on the Day Turn Network. UPS/USPS-4.

65 USPS-T-15, p. 2.

66 Institutional response to UPS/USPS-3.

67 Institutional response to UPS/USPS-T15-13. See response to UPS/USPS-T4 for a tabulation of Day-Turn Network cubic footage by class.

case,[68] the better approach may be for the Commission to once again do what it did in Docket R2005-1 and adhere to its prior treatment of these costs.

Under that treatment, the costs of the Day-Turn network would be shared among all classes of mail in proportion to their respective capacity usage. The result would be to attribute a somewhat higher proportion of these costs to classes other than Priority and First Class mail than would result from my preferred approach outlined above.

[68] See UPS/USPS-T15-8 and 9 (partially objected to by the Postal Service).

KEVIN NEELS **Principal**

Kevin Neels directs the Transportation Practice at *The Brattle Group*. Dr. Neels has more than 30 years experience as a consultant and expert witness in the rail, trucking, courier, postal, aviation, and automotive industries. He has led many significant engagements relating to competition, market structure, pricing, revenue management, distribution strategy, regulation, and public policy. His work has addressed issues related to system planning, competition policy, privatization, and congestion management.

Prior to joining *The Brattle Group*, Dr. Neels served as Vice President and leader of the transportation practice at Charles River Associates. He has also served as a researcher in the Urban Policy Program at the Rand Corporation and the Transportation Studies Program at the Urban Institute, as a Director in the Transportation Practice at the consulting firm of Putnam, Hayes & Bartlett, as a Management Consultant in the Transportation Practice of the firm now known as KPMG. Dr. Neels is currently Vice Chairman of the Committee on Freight Transportation Economics and Regulation of the Transportation Research Board, an arm of the National Academy of Sciences. He is also a member of the Transportation Research Board's Committee on Airline Economics and Forecasting.

Dr. Neels has authored numerous research reports, monographs and articles for peer-reviewed journals. He has often been asked to offer expert testimony in legal and regulatory proceedings. He regularly serves as an invited speaker at conferences and industry forums, and his opinions and observations on industry developments are frequently quoted in the popular and trade press. Dr. Neels earned his Ph.D. from Cornell University.

A sample of the project experience of Dr. Neels is shown below.

FREIGHT TRANSPORTATION

- For a major U.S. based freight railroad, Dr. Neels developed a system of models to predict traffic levels and revenues by carrier for the North American freight rail market under alternative scenarios regarding market structure and regulatory policy. This modeling system incorporated detailed representations of the North American rail and highway networks, algorithms for determining shipment routing under alternative operating policies, and a series of statistical models capturing the underlying structure of freight traffic flows.

- For a non-U.S. government client, Dr. Neels led the team serving as fairness advisors in connection with the privatization of a government owned railroad. This engagement involved review of and commentary upon the bidding procedures employed in the transaction, analysis of the extent to which different bidders addressed and resolved policy concerns expressed by government officials, and advising government officials regarding the extent to which the various bids received reflected the full market value of the operation.

- On behalf of a provider of services to long-distance trucking firms, Dr. Neels offered expert testimony on the status of the trucking market, and on the extent to which a downturn in that market affected the value and economic viability of trucking firm service providers during a period in which his client concluded a series of acquisitions.

- In testimony before the U.S. Postal Rate Commission, Dr. Neels offered expert testimony analyzing the procedures used by the U.S. Postal Service to measure the transportation costs associated with its various products. His analysis addressed a wide range of issues, including the Service's use of its dedicated air network for transportation of expedited products, fieldwork procedures used to collect data on composition of the mail stream at different points in the rail network, potential biases in the assignment of transportation costs to products, and flaws in econometric analyses of transportation cost variability introduced by other witnesses in the proceeding.

- In support of a key economic witness in a hearing regarding refined petroleum product pipeline rates before the Federal Energy Regulatory Commission, Dr. Neels conducted an analysis of 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 Class 1 railroad, Dr. Neels provided consultation and economic analysis regarding rail freight regulatory policy in the U.S.

- For a major U.S. railroad involved in a commercial dispute over trackage rights and trackage fees, Dr. Neels conducted a detailed analysis of over-the-track incremental operating costs. This analysis involved, among other things, extensive use of the Uniform Rail Costing System maintained by the Surface Transportation Board.

- For a major North American rail car manufacturer involved in a patent infringement lawsuit Dr. Neels offered expert testimony on the economic value of an innovative car design relative to existing designs, and on the damages imposed on the manufacturer as a result of infringement of its patents on this new design.

- For an express package delivery carrier intervening in a rate case before the U.S. Postal Rate Commission, Dr. Neels 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.

AIRLINE INDUSTRY

- For a major U.S. network air carrier Dr. Neels was a key member of a team of consultants charged with the development of an operations research strategy aimed at improving the carrier's performance and competitive standing across a broad range of areas of operation, including financial planning, scheduling, crew management, maintenance, flight operations, air cargo sales, marketing, reservations and distribution. This engagement involved extensive onsite interviews with numerous operating personnel at the carrier's headquarters. It identified a lengthy list of investment opportunities involving the application of a variety of advanced decision support tools.

- For a major international air carrier accused of monopoly leveraging and attempted monopolization of a key market, Dr. Neels prepared a report analyzing the carrier's use of corporate discounts and travel agent override commissions, and rebutting arguments that these agreements could be construed as exclusive dealing.

- For a major U.S. air carrier, Dr. Neels 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.

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

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

- In an antitrust dispute in the airline industry, Dr. Neels was retained by the defendant to critique and rebut damage calculations prepared by experts for plaintiffs. Dr. Neels conducted a detailed analysis of the assumptions underlying plaintiff estimates of lost profits, documenting numerous instances in which specific assumptions were contradicted by industry experience or by business plans prepared by the plaintiff prior to litigation. He showed that correcting these errors resulted in dramatic reductions in

estimates of plaintiff damages. The case was eventually dismissed without an award of damages.

- Dr. Neels 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.

- To support expert testimony in an antitrust case between two major U.S. air carriers, Dr. Neels developed and estimated a set of statistical models for estimating the effects of GDS display bias on the booking patterns and revenues of the affected airlines. As part of this effort Dr. Neels conducted an extensive analysis of the histories of the carriers in questions and of the development of these computerized 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.

AIRPORT AND AIRWAY SYSTEM

- For the International Air Transport Association, Dr. Neels 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.

- Dr. Neels 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.

- For the public authority responsible for the operation of one of the largest international gateway airports in the country, Dr. Neels 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.

- For the operator of a major U.S. hub airport, Dr. Neels developed a series of forecasting models for use in evaluating likely passenger responses to the introduction of new types of ground access services.

- For the government of a Mexican province, Dr. Neels developed a framework for use in evaluating proposals for new airport development.

- For a conference sponsored by the National Academy of Sciences, Dr. Neels analyzed the policy issues raised by proposals for using pricing to manage demand and reduce delays at major airports. His analysis used standard antitrust tools to assess the extent of concentration in the market for airport services, and evaluated the potential for anticompetitive behavior in that market.

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

- For an international gateway airport, he evaluated the impacts and effectiveness of a wide range of strategies for reducing delays. The policies considered included regulatory constraints on aircraft size, diversion of service to adjacent airports, a variety of pricing and slot allocation mechanisms, and expansion of facility capacity.

AEROSPACE MANUFACTURING

- For a consortium of aerospace manufacturers, Dr. Neels examined and evaluated the economic, financial and policy arguments for including manufacturers as members of government sponsored insurance against war and terrorism risks. His analysis examined the nature of the risks in question, the state of the commercial market for insurance against them, the realities of multi-party tort litigation in settings where the parties enjoy dramatically different levels of insurance coverage, and the likely long-term economic impacts if aerospace manufacturers were because of the shut down of the commercial insurance market, forced involuntarily to self-insure against these risks.

- For a major manufacturer of business jet aircraft accused of monopoly leveraging and attempted monopolization Dr. Neels conducted an analysis of the structure of the business jet aircraft market, evaluating the extent to which availability of comparable models from other manufacturers constrained the ability of the defendant in the dispute to exercise market power.

- For a U.S. based manufacturer of business aircraft, Dr. Neels quantified the damages resulting from significant defects in a major subcontractor-supplied aircraft component. These defects had resulted in a number of plane crashes and the eventual grounding of a significant portion of the

manufacturer's fleet. Dr. Neels developed a sophisticated econometric model that controlled for the effects of a number of market-related background factors, and isolated the effects of the component defects on sales, revenues and profits.

- For a manufacturer of high end business jet aircraft involved in a dispute over the closure of a manufacturing plant, Dr. Neels offered expert testimony on the status of the business jet aircraft market at the time of the closure and its effects on new orders, backlog and revenue for the manufacturer. His analysis focused in particular on the effects on the business jet aircraft market of the economic downturn that began in 2001 and the events on September 11, 2001. In response to testimony offered by opposing experts, he also analyzed the decision making process that led to closure of the plant, the options open to management, and the economic justifications for closing the plant.

AUTOMOTIVE INDUSTRY

- 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 a major auto 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 automobile dealers engaged in a dispute with a distributor, Dr. Neels offered expert testimony analyzing the new auto allocation procedures used by the distributor, the distributor's policies regarding accessorization of new vehicles, and their economic effects of individual dealers. This work involved extensive econometric modeling of the dynamics of dealer inventories and the determinants of time to sale for individual vehicles.

- For a consortium of U.S., European and Japanese auto manufacturers and related firms, Dr. Neels played a key role in a major investigation of long-term trends in mobility. This study was worldwide in scope, addressing urban, rural and intercity passenger and freight transportation in both the developed and the developing world. Its particular focus was on the sustainability of the current transportation system, and the extent to which

exhaustion of fossil fuels, environmental constraints, infrastructure shortages or institutional barriers were likely to constrain mobility over the next several decades.

OTHER PROJECT EXPERIENCE

- For an operator of vehicle and passenger ferry services to offshore islands, Dr. Neels conducted a detailed analysis of fares, costs, market structure, the extent to which particular services are subsidized, the structure of the market for ferry services, and the likely effects of changes in conditions of entry.

- For a major U.S. manufacturer that had been the target of industrial espionage and the organized theft of technology and other trade secrets, Dr. Neels offered testimony involving the stolen technology and, using a reasonable royalties approach, the damages suffered by the U.S. manufacturer as a result of the theft. At the conclusion of a jury trial in the United States, the manufacturer received a substantial damage award.

- For the U.S. Department of Energy, Dr. Neels 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, Dr. Neels provided consultation on statistical issues and worked closely with a team of analysts examining the economics of fuel substitution.

- Dr. Neels 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.

- 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, Dr. Neels 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*.

- Dr. Neels 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 New York State Science and Technology Foundation, Dr. Neels participated in a project to facilitate the transfer to civilian firms and the commercial exploitation of photonics technology developed for military applications at a research center established at a major New York State military installation. This project included an assessment of the commercial value of the technology, the identification of firms in the vicinity of the research center with the research focus and capabilities to absorb the technology, and the design of institutional mechanisms for facilitating and supporting technology transfer.

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Transportation Research Board

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