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BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON, D.C. 20268-0001

Postal Rate and Fee Changes, 1997

Docket No. R97-1

DIRECT TESTIMONY OF
MICHAEL D. BRADLEY
ON BEHALF OF
UNITED STATES POSTAL SERVICE

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AUTOBIOGRAPHICAL SKETCH

My name is Michael D. Bradley and I am Professor of Economics at George Washington University. I have taught economics there since 1982 and I have published many articles using both economic theory and econometrics. Postal economics is one of my major areas of research. I have presented my research at the various professional conferences and I have given invited lectures at both universities and government agencies. Beyond my academic work, I have extensive experience investigating real-world economic problems, as I have served as a consultant to financial and manufacturing corporations, trade associations, and government agencies.

I received a B.S. in economics with honors from the University of Delaware and as an undergraduate was awarded both Phi Beta Kappa and Omicron Delta Epsilon for academic achievement in the field of economics. I earned a Ph.D. in economics from the University of North Carolina and as a graduate student I was an Alumni Graduate Fellow. While being a professor, I have won both academic and nonacademic awards including the Richard D. Irwin Distinguished Paper Award, the American Gear Manufacturers ADEC Award, a Banneker Award and the Tractenberg Prize. I am member of the editorial board for Economic Inquiry.

I have been studying postal economics for over a dozen years, and I participated in several Postal Rate Commission proceedings. In Docket No.

R84-1, I helped in the preparation of testimony about purchased transportation and in Docket No. R87-1, I testified on behalf of the Postal Service concerning purchased transportation. In Docket No. R90-1 and the Docket No. R90-1 remand, I presented testimony concerning city carrier costing. I returned to transportation costing in Docket No. MC91-3. There, I presented testimony on the existence of a distance taper in postal transportation costs. In Docket No. R94-1, I presented an econometric model of access costs and in Docket No. MC97-2 I filed a new econometric analysis of purchased highway transportation.

Besides my work with the U.S. Postal Service, I serve as a consultant to Canada Post Corporation. I have given it assistance in establishing and using its product costing system and provide expertise in the areas of cost allocation, incremental costs, and cross-subsidy. Recently, I provided expertise about postal costing to the International Post Corporation.

PURPOSE AND SCOPE

My testimony is part of the new Postal Service study of mail processing labor costs. The purpose of my testimony is to produce econometric estimates of the variability of mail processing labor costs. In the past, the Postal Service has simply assumed that mail processing labor costs were proportional to volume. Rather than just maintaining this old, untested assumption, I produce econometric evidence that permits evaluating it. To be specific, I produce evidence that justifies the proportionality assumption for some mail processing activities, but contradicts it for others. I thus improve the accuracy of the Postal Service's costing procedure by investigating, for the first time, the actual relationship between the cost of mail processing labor and its cost drivers.

The key characteristics of my study are:

(1) It follows an operational approach to describing how costs are generated on the workroom floor.

(2) It investigates the relationship between volume and cost at the micro level, at the level of the mail processing activity.

(3) It applies an extensive data set that incorporates variation between the cost driver and cost both across facilities and through time.

These characteristics reveal that I constructed a model of mail processing costs that is "dynamic." It is dynamic in the sense that it captures the effect of changes in the workroom floor, both for changing volume flows and changing mail processing methods.

The model of mail processing is also "dynamic" in a very different way. The Postal Rate Commission has raised concerns about the ability of the old Postal Service mail processing costing framework to adapt to an environment of change. As the Commission stated:[1]

> The shift to automation has caused a number of questions. The effects of this change are complex and have not been analyzed. Some parties have argued that IOCS may no longer be well-suited to a changed operating system.

Because my model is constructed at the level of the individual mail processing activity and because it is based upon operational data, it provides a framework that is flexible enough to adjust to future changes in the mail processing environment. For example, I am able to include an analysis, albeit preliminary, of remote encoding despite the fact that the operation just started in full force in Fiscal Year 1996.

In addition, because the data are operational, the model can be adapted as the size and nature of different operations change. As new operations arise, their data will become automatically available. This is a substantial improvement over the previous costing framework.

This testimony represents our attempt to be responsive to the Postal Rate Commission request for a costing framework that can produce accurate product costs in a changing environment.

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[1]See, PRC Op., R94-1, at III-8.

I. THE APPROACH FOR STUDYING THE VARIABILITY OF MAIL PROCESSING LABOR IS STRONGLY GROUNDED IN ACCEPTED POSTAL COSTING PRACTICE.

The Postal Service firmly grounded its new approach to measuring volume variable mail processing labor costs in accepted postal costing methods. Economists have characterized the approach as the "volume variability-distribution key" method and the Postal Service, the Commission, and other participants have used it.[2]

In this method, the Postal Service calculates subclass-specific volume variable costs in two steps. In the first step, sometimes called the "attribution step," the Postal Service multiplies accrued cost times the elasticity of those costs with respect to a cost driver. This multiplication produces the pool of volume variable cost.[3] In the second step, sometimes called the "distribution step," the Postal Service distributes the pool of volume variable cost to individual subclasses.

My testimony is concerned with the first step. In particular, I calculate the

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[2] For a description of this method, see, Michael D. Bradley, Jeff Colvin and Marc A. Smith, "Measuring Product Costs for Ratemaking: The U.S. Postal Service," in Regulation and the Evolving Nature of Postal and Delivery Services, M. Crew and P. Kleindorfer, eds. Boston: Kluwer Academic Publishers, 1992 at page

[3] In postal costing, this elasticity is often called the "volume variability" of cost although it is formally the variability of cost with respect to movements in the cost driver. To avoid confusion, I maintain that convention here and use the terms "volume variability" and "cost elasticity" interchangeably throughout my testimony.

"volume variabilities" or cost elasticities for the accrued cost pools.[4] The calculation of volume variabilities under this method requires identification of the cost driver and then requires estimating of the cost response to changes in the cost driver.

To select an appropriate cost driver, I must consider the "output" of a particular postal activity. In purchased highway transportation, for example, the output is moving cubic feet of mail over the distance between facilities. Thus, in that cost component, the cost driver is cubic foot-miles. The object of mail processing activities is sorting mail so that it can be quickly and accurately directed to its destination. This suggests that the natural driver of cost is the sortation of mail. In postal jargon, one calls the sorting of a piece of mail a "piece-handling" and I selected piece-handlings as the cost driver for mail processing labor costs. To complete my analysis, I had to find the relationship between variations in piece-handlings and the response in mail processing labor cost. The bulk of my testimony explains how I did this.

To improve the accuracy of his distribution keys, witness Degen has disaggregated total mail processing labor costs into activity-specific cost pools. I follow his approach and estimate cost elasticities at the activity level. The accrued cost pools are defined along two dimensions: the type of mail

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4 For a discussion of the distribution methodology, see the testimony of witness Degen (USPS-T-12).

processing facility and the mail processing activity.[5] There are thus two levels of classification in his cost pools, the types of facilities and the activities within those facilities. The groups of facilities include:

1. Those sites who report data electronically to the Postal Service corporate data base through the Management Operating Data System (MODS) and are termed "MODS offices."

2. Those sites who do not report through the MODS system and are termed "non-MODS offices."

3. The Bulk Mail Centers (BMCs) who report data electronically to the Postal Service corporate data base through the Productivity Information Reporting System (PIRS).

At present, I can estimate cost elasticities for activities within MODS offices and BMCs, but not for non-MODS offices. This is because the non-MODS offices do not submit piece-handling data to the corporate data base. Even within MODS offices, moreover, there are certain mail processing activities

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[5] See the testimony of witness Degen for a description of the facility types and the testimony of witness Moden for a description of the mail processing functions in each activity.

for which I cannot estimate a variability because of the lack of piece-handling data. For example, the sorting of mail at stations and branches of mail processing facilities falls into this category. These costs are not ignored in the Postal Service cost model, however. Because there are similar activities in MODS offices or BMCs, I can provide witness Degen with proxy variabilities for these cost pools.

There are two instances, moreover, in which piece-handling data are not reported through MODS, but it is possible to estimate a variability. The registry activity and the remote encoding activity do not report volumes to MODS, but data on an alternative cost driver is available in each case. I use these alternative cost drivers to estimate cost elasticities for these two activities.

In total, I have estimated twenty-five separate cost elasticities for mail processing labor and a listing of the cost pools and calculated cost elasticities are presented in Table 1.

Table 1
Cost Elasticities for Mail Processing Activities

Type of Office	Activity	Elasticity
MODS	BCS Sorting	95%
MODS	OCR Sorting	79%
MODS	LSM Sorting	91%
MODS	FSM Sorting	92%
MODS	Manual Letter Sorting	80%
MODS	Manual Flat Sorting	87%
MODS	Manual Parcel Sorting	40%
MODS	Manual Priority Mail Sorting	45%
MODS	SPBS - Priority Mail Sorting	80%
MODS	SPBS - Non Priority Mail Sorting	47%
MODS	Cancellation and Mail Prep	65%
MODS	Opening - Pref Mail	72%
MODS	Opening - Bulk Business Mail	74%
MODS	Pouching	83%
MODS	Platform	73%
MODS	Remote Encoding	100%
MODS	Registry	15%
BMC	Sack Sorting Machine	99%
BMC	Primary Parcel Sorting Machine	86%
BMC	Secondary Parcel Sorting Machine	97%
BMC	Irregular Parcel Post	75%
BMC	Sack Opening Unit	72%
BMC	Non Machinable Outsides	67%
BMC	Platform	53%
BMC	Floor Labor	60%

II. METHODS USED FOR CALCULATING THE VARIABILITIES OF MAIL PROCESSING LABOR

The calculation of mail processing variabilities depends upon the construction and estimation of econometric cost models. Econometric models are a mixture of economic theory and statistics. The results they produce depend upon four crucial factors. Those factors are: (1) the variables included in the model, (2) the nature of the data used, (3) the functional form of the equation and (4) the econometric methods used.

I discuss, in this section, the role of each of these issues in the estimation of the mail processing variabilities. I also provide my justifications for the inevitable research decisions that I made along the way. Figure 1 illustrates the research process that I used to develop the variabilities. It also serves as an outline for the material presented in this section.

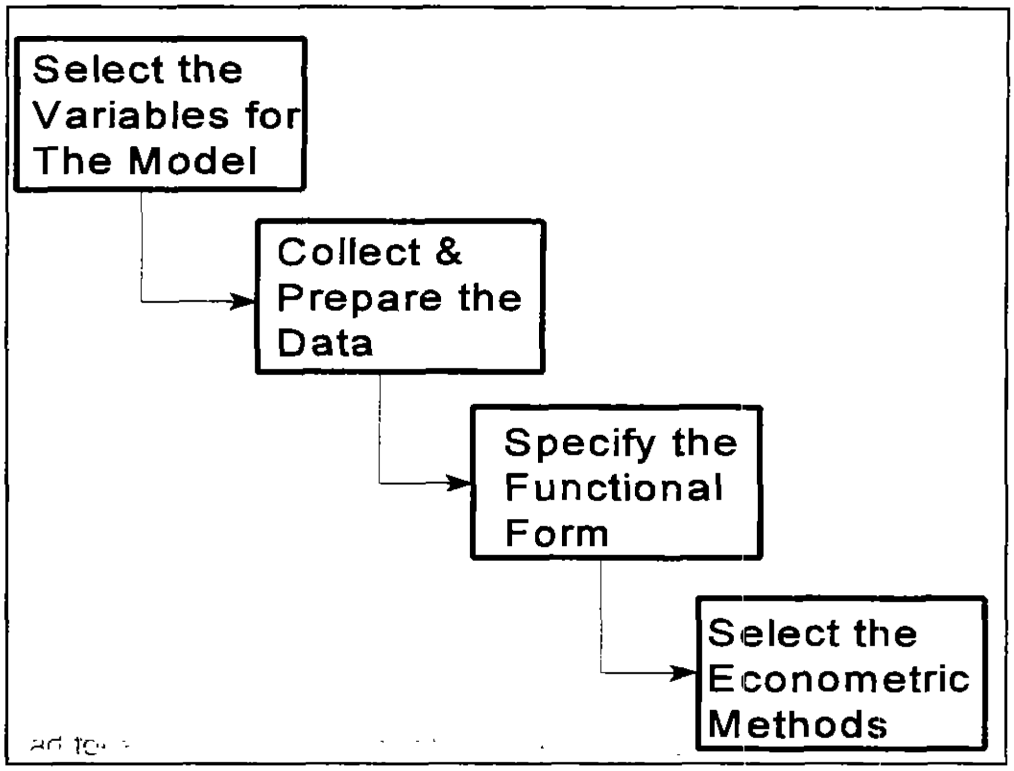

Figure 1: The Research Path

A. Choosing the Variables to Include in the Model.

I estimate econometric equations for three types of activities, direct activities at MOD offices, allied labor activities at MOD offices, and activities at BMCs. In this section I discuss the choice of variables that I included in the equations I estimated for each of these types of activities.

1. Choosing the variables to include in equations for direct activities at MODS offices.

Direct activities at MODS offices are the activities in which the Postal Service sorts mail manually, with mechanized equipment, or with automated equipment. To find the volume variability of mail processing labor costs for these activities, I estimate an econometric cost equation for each individual activity.

A first step in estimating an econometric equation is the selection of the variables to be included in the model. This selection includes the choice of a dependent, or left-hand-side variable and also the set of explanatory or right-hand-side variables. In cost equation estimation, this effort requires identifying the relevant measure of cost and the set of cost drivers that cause variation in that cost.

In constructing my labor cost equations, the first variable to be chosen is the measure of labor cost, which will serve as the dependent or left-hand-side variable. The dependent variable in a cost equation should be a variable that captures the additional cost associated with providing the output being produced. For mail processing labor cost, the variations in mail processing hours are the variations in cost. Consequently, I use an activity's recorded MODS or PIRS hours as the dependent variable in its cost equation.

Using hours as the dependent variable has two advantages. First, the Postal Service directly records, in MODS or PIRS, the hours accumulated in each activity, in each accounting period, at each site. As a result, use of hours as a dependent variable requires no additional constructions or transformations. In contrast, if I had used the dollar value of compensation in an activity as the dependent variable, then I would have had to construct an estimate of the average wage paid in that activity, at each site, in each accounting period.

The second advantage of using hours as the dependent variable comes from the fact that recorded hours is a "real" variable that inflation does not influence. Therefore, hours are directly comparable through time, and I do not have to adjust them for inflation.

The primary driver of costs in any activity is the number of pieces sorted in that activity. To measure the number of pieces sorted in activities in MODS offices, I use the Total Piece Handlings or TPH at the activity level.

The nature of the labor adjustment process in mail processing facilities is such that current staffing may depend not only upon volume in the current period but also upon volume in the previous period. To allow for this gradual labor force adjustment to changes in piece-handlings, I included a lagged TPH term along with the current TPH term.

Another important consideration in measuring the volume variable costs of mail processing labor is the effect that changing technology may have on those costs. It is well known that the technology for sorting mail has evolved over the last ten years and it is continuing to evolve. Thus, it is important to include in the econometric specification a method to account for the effects of technological change on hours. If I make no such specification, it is possible to mistakenly ascribe changes in hours that come from technological change to variations in volume. Econometricians typically account for technological change with an autonomous time trend:[6]

> For example, aggregate models of productivity will usually include a trend variable, as in:
>
> $$\ln\left(\frac{Q}{L}\right)_t = \beta_1 + \beta_2 \ln\left(\frac{K}{L}\right)_t + \delta t + \varepsilon_t.$$
>
> This provides an estimate of the "autonomous growth in productivity," usually attributed to technical change. In this equation, δ is the rate of growth of average product not attributable to increases in the use of capital.

In my analysis, hours are the dependent variable so an autonomous time trend captures the autonomous growth (or decline) in hours. Thus, in my equations, the time trend's coefficient measures the rate of growth (or decline) in hours *not* attributable to increases (or decreases) in piece-handlings. A trend approach is particularly well suited for looking at mail processing labor costs because changes in technology generate smooth changes in mail processing productivity. Although the Postal Service may introduce a new machine in a particular period, it takes many accounting periods before the full adjustment to that new technology has occurred.

In addition, for the Postal Service, the time trend also picks up changes in

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6 See William H. Greene, Econometric Analysis, Macmillan Publishing Company, New York, 1993, at page 239.

the way the activity is used. The "technology" of manual sorting may not change, but the way that the manual sorting activities are used has changed significantly. At one time, manual sorting activities were the primary way in which mail was sorted and the productivity in manual activities reflected this importance. In more recent years, as more and more mail is sorted on automated equipment, manual sorting activities are used as a backstop or reserve capacity technology. To the extent that these operational changes affect productivity, a time trend would account for the change in productivity through time.

Because of the importance of this issue, I go beyond this simple time trend approach in three important ways. First, I allow for a nonlinear time trend by including a second order trend term in the equation. This more general specification is less restrictive and lets the actual historical performance in hours dictate the nature of the autonomous trend in hours. Next, because of the fundamental restructuring of Postal Service operations in FY 1993, I allow for a segmented trend. In a segmented trend, the trend is "broken" in the sense that it has one shape before the critical period and another after. In my estimated equations, I specify a segmented trend:

$$t_1 = \begin{cases} No.\ of\ periods\ from\ 8801 & if\ FYAP \le 9213 \\ 0 & if\ FYAP > 9213 \end{cases}$$

$$t_2 = \begin{cases} 0 & if\ FYAP \le 9213 \\ No.\ of\ periods\ from\ 9301 & if\ FYAP > 9213 \end{cases} \tag{1}$$

The third refinement that I make is done because of the nature of the technological change in mail processing. The Postal Service has worked to automate the mail stream and it is the advent of automation that embodies technological change. As automation expands on the workroom floor, the Postal Service diverts mail from manual activities and this diversion could have an impact on the nature of manual activities.

In particular, the amount of the mail stream that the Postal Service has diverted to automation may influence the hours required in a manual activity. For example, only machinable mail can be diverted to automated activities, suggesting that increasing the degree of automation will cause a decline in the average quality of the mail remaining in the manual activities.

To account for this possibility, I include a variable that is an indicator of the degree to which the Postal Service has diverted the mail stream from manual activities. For letter activities, I define a variable called the "manual ratio" which is the ratio of manual letter TPH to the sum of all manual letter TPH, mechanized letter TPH, and automated letter TPH. I include this variable in the cost equation to account for non-volume changes in hours, particularly in manual activities, associated with the diversion of mail from those activities. If the diversion of mail from manual activities to automated activities causes the quality of the remaining mail to fall, then the hours required to sort a given volume of mail will rise.[7] This means that a decrease in the manual ratio would cause an increase in the hours associated with any level of piece handlings.

I calculate a similar measure for the flats mail stream, in which I define the manual ratio as the ratio of manual flat piece-handlings to the sum of manual and FSM piece handlings.

Finally, one can interpret the manual ratio as a general, but inverse, measure of the degree of automation. As automation rises, the percentage of mail sorted on automated equipment rises and the manual ratio declines. I therefore include it in the equations for all of the letter and flat activities, regardless of sorting technology. As expected, however, its impact is largest in the manual activities.

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[7] In this context, mail quality is defined as address readability or physical characteristics that make the mail difficult to case.

2. Choosing the variables to include in equations for allied activities at MODS offices.

Modeling allied activities presents more of a challenge than modeling direct activities because the MOD System does not record any measure of workload for these activities. Unlike direct activities, allied activities do not accomplish the piece sortation of mail. Rather, they provide the support functions, like working on the platform or in opening units, required for processing the mail. Because no direct measure of workload is available, I must use an indirect measure.

Allied activities exist to support the direct piece sorting of mail and it is in this sense that they are "allied" with direct activities. A natural indirect measure of workload for allied activities is the amount of mail sorted in direct activities. The logic is straightforward: as a site works more mail, it needs more support functions. The econometric equation will measure how rapidly allied hours grow when piece-handlings in direct activities grow. Although it would be preferable to have a cost driver that directly measures workload in the allied activity, a good first attempt at measuring the variability of allied hours can be made by testing the assumption that allied hours are caused by the piece handlings in direct activities.[8]

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[8] This is an area for possible future research. There is already a preliminary study underway to begin to collect data on direct cost drivers for the (continued...)

In its simplest form, this assumption implies that the primary right-hand-side variable in any site's allied labor equations would be the aggregate TPH for all letter and flat sortation activities at that site. However, given the amount of data available, I can refine this aggregate approach. Specifically, I allow for the possibility that different sorting technologies have different allied labor requirements. Instead of placing a single measure of TPH on the right-hand-side of the allied equations, I include separate measures for each of the major sorting technologies: manual letter sorting, manual flat sorting, mechanized letter sorting, mechanized flat sorting and automated letter sorting. This approach permits a flexible response in allied labor, by activity, to variations in workload in the different sorting technologies. The overall cost elasticity for allied labor hours is the sum of the individual elasticities for each of the cost drivers.

Also, with the various sorting technologies individually represented in the equation, there is no need to also include the manual ratio. If, for example, automated TPH are rising relative to all other TPH, then the estimated coefficients for the automation variable will capture the response in allied labor hours.

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[8](...continued)
platform. Similar efforts for other allied labor activities would provide a potentially useful refinement of the present approach.

3. Choosing the variables to include in equations for activities at BMCs.

Bulk Mail Centers report their data to a different system than do MODS offices. BMCs report to the PIRS system, but do so in a way that parallels the reporting to the MOD system. The BMCs report hours, at the activity level, just as in MODS but the measure of workload will vary with the activity. In most cases, the measure of workload continues to be piece-handlings. In sack activities, however, the measure of workload will be the number of sacks being handled. For simplicity I will continue to call the cost driver total piece-handlings, but keep in mind that in the sack activities, the "piece" is a sack.

For the same reasons that I used recorded hours as the dependent variable in the MODS equations, I use the hours recorded for the activity in PIRS, by each BMC, as the dependent variables in the equations for BMC activities. In like fashion, for the direct BMC activities the primary cost driver is total piece-handlings, and I enter it in the equation with both its current and lagged values. I enter the autonomous time trends in the BMC equations in the same way they entered the MODS equations. I have not included the manual ratio in the BMC equations, however, because BMCs have not experienced the diversion of mail from manual activities to automated activities that has taken place at MODS facilities.

BMCs have two allied activities, the platform activity and a more general allied activity called "floor labor." The BMC platform activity has two primary functions, the cross-docking of mail and the handling of mail that will be or has been processed in the facility. Because of the importance of cross-docking on the BMC platform, the PIR system collects data on the number of pallets cross-docked. It would be possible, therefore, to estimate an equation in which platform hours were regressed upon the cross-dock variable. This would miss, though, the handling of mail that is sorted in the BMC.

To capture the effect of this additional workload, while keeping the specification relatively parsimonious, I use the BMC measure of facility-wide workload, Total Equivalent Pieces (TEP). TEP combines the volume counts from sack sorting, parcel sorting and tray handling. The platform equation thus has two cost drivers, the amount of cross-docked pallets and the TEP for mail sorted in the BMC.

The floor labor activity provides general support for the sorting activities in the BMCs. Like the MODS allied equations, I specify multiple cost drivers for the BMC allied equations. Discussion with operational experts led to a specification which had a three way split in the cost driver with separate volume counts for the mechanized parcel sorting activities, the manual parcel post activity, and all other sorting activities.

4. Choosing variables for the remote encoding and registry activities.

As mentioned above, there are two activities for which MODS piece handling data are not available, but for which an alternative cost driver is available. I am taking a "best-available-information" approach to both of these activities because they are both important activities and are not similar to other activities for which piece handling data are available. These two activities are the remote encoding activity and the registry activity.

The remote encoding activity consists of viewing images taken on the OCR and keying the address information that can be extracted from the image. The cost in this activity comes from the hours spent processing the images. I use those hours as the dependent variable in the regression. The cost driver is the number of images processed. The number of images processed is available from tracking reports and it is the variable that I use on the right-hand-side of the econometric equation.

Hours are available from the MOD system for the registry activity but no piece handling counts are recorded. Fortunately, however, the registry activity is different from other operations in that it is dedicated to the handling of a single type of mail. This characteristic allows me to use national RPW Registry mail volumes as a proxy for the piece handlings within the registry operation.

B. The Nature of the Data Used.

In analyzing the relationship between costs and volumes, a researcher has traditionally had to pick either cross-sectional or time series data. Cross-sectional data have the advantage of incorporating information from a number of micro units, like processing facilities, but have several disadvantages. First, using cross-sectional data to control for non-volume variations in cost across facilities is difficult. Second, a cross-sectional data base cannot capture the dynamic response of cost to changes in volume through time.

The use of time series data has the advantage of permitting dynamic analysis but has the disadvantage of being relatively aggregate and thus producing a limited number of data points. While time series data can be used for cost analysis, a lack of data often precludes its use.

More recently, researchers have been taking advantage of the enhanced richness of panel data for estimating cost equations. Panel data consist of a set of repeated cross sectional observations on the micro units of interest. It thus includes both a cross-sectional dimension and a time series dimension and holds several advantages over either cross-sectional or time series data.

First, a panel data set provides many more observations than either a cross- sectional data set or at time series data set. For example, in the instant analysis, a cross-sectional data set for a MODS operation could have as many as 300 observations, one for each site. Alternatively, a time series data set could have as many as 117 observations, one for each of the accounting periods in the 9 fiscal years for which data are available. In contrast, a panel data set, by making use of both of these dimensions could have as many as 35,000 observations. The availability of substantially more data both increases the precision of the estimated parameters and permits the construction of more sophisticated econometric models.

A second advantage of panel data is that it alleviates the problem of multicollinearity. Because the explanatory variables vary over two dimensions in a panel, they are less likely to be highly correlated with one another.

Perhaps the most important advantage of panel data, however, is its ability to mitigate or eliminate estimation bias:[9]

> Besides the advantage that panel data allows us to construct and test more complicated behavioral models than purely cross-sectional or time-series data, the use of panel data also provides a means of resolving or reducing the magnitude of a key econometric problem that often arises in empirical studies, namely, the often-heard assertion that the real reason one finds (or does not find) certain effects is because of omitted (mismeasured, not observed) variables that are correlated with explanatory variables. By utilizing information on both the intertemporal dynamics and the individuality of the entities being investigated, one is better able to control in a more natural way for the effects of missing or unobserved variables.

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[9] See Cheng Hsiao, Analysis of Panel Data, Cambridge University Press, New York, 1986 at page 3.

Fortunately, panel data exist for the analysis of mail processing labor costs. The Postal Service collects data on hours and piece-handlings at a cross-section of mail processing facilities in each accounting period. It is thus possible to construct a data set that consists of a panel of repeated cross-sectional observations.

We have two primary sources of data for our analysis: MODS and PIRS. I describe each below along with the methods used to verify and clean the data.

1. The Management Operating Data System is an operational data base that provides data on piece-handlings and hours.

The Management Operating Data System is an operational data base used for planning and managing mail processing operations:[10]

> The Management Operating Data (MOD) System provides local postal management with information necessary to plan and control activities within a postal office. Designated MOD System offices input and report into the MOD System data concerning actual versus projected workhours and workloads.

The data are recorded by a three-digit operational code at each facility that reports to the MOD System. Each code represents a particular mail

[10] See Handbook M-32, Management Operating Data System at page 113. This document is provided in Library Reference H-147.

processing operation:[11]

> MOD System operations, represented by three-digit numbers are provided for recording all workhours in post offices according to the function or activity being performed. A mail volume count is provided in operations that distribute or handle mail.

In fact, multiple three digit codes may be used for the same mail processing activity. This may occur because different three digit codes reflect different sortation schemes being run. For example, consider the flat sorting machine (FSM) activity. MODS codes 141 through 148 are all FSM operations, but, as Table 2 shows, each is a different sort scheme.

Table 2
Examples of Different MODS Codes Associated with the Flat Sorting Machine Activity

MODS Code	Sort Scheme
141	Outgoing Primary
142	Outgoing Secondary
143	Managed Mail
144	SCF
145	Incoming Primary
146	Incoming Secondary
147	Box Section
148	Incoming Non-Scheme

[11] Id., Appendix A, at page 1.

In other cases, the Postal Service provides the multiple-code option to local facilities to allow them to collect even more detailed data on a local basis. For example, MODS codes 110 through 114 are all for Opening Unit Outgoing - Pref.

In estimating econometric equations, I was faced with a choice of the appropriate level of analysis. One important consideration in making that choice is the homogeneity of the cost driver. It is preferable to specify a model in which the cost driver represents a relatively homogeneous activity. In the technology of mail processing, this homogeneity occurs at the level of the activity, like manual letter sorting or mechanized flat sorting. The cost driver is essentially the same for all of the individual operations within this activity, but is very different across activities. I thus chose to estimate the equations at the level of the activity.

In addition, because of the local variations in recording hours and volume described above, the MODS data are most reliable at the level of the activity. The activity is defined as a group of three-digit MODS codes all associated with the same technology. For example, workers "clock in" to an operation and a site records those hours under that three-digit code. Workers clock into the piece of equipment that they are working on, but may or may not "reclock" when the sort scheme is changed. For this additional reason, I pursue my econometric analysis at the activity level. Library Reference H-148 provides a listing of the sets of three-digit MODS codes included in each activity for which I estimate a variability, but I provide the example of the manual flat activity here:

Table 3 MODS Codes Included in the Manual Flat Activity	
MODS CODES	**Activity**
060-061, 064-68	Outgoing Primary
069	Riffle Flat Mail
070-072	Outgoing Secondary
073	State Distribution
074	SCF Distribution
075-079	Bulk Business Distribution
170-174	Incoming Primary
175-177	Incoming Secondary
178	Box Distribution
179	Secondary Box Distribution

The MODS is an operational data base and is not designed specifically for econometric analysis. As such, any user should carefully examine it for data consistency and outliers. Because of the size of my extract from MODS, it is impractical to do this on a visual basis and I must use other methods of data filtering. Library Reference H-148 provides the details of the data construction process but I explain the general process here.

In constructing the data set, three factors had to be considered:

1. Not all sites perform all activities. The number of observations used in the econometric analysis will change from activity to activity.

2. Some sites added activities through time. For example, many sites added BCS activities midway through the time period. New activities will have fewer observations than activities that have been widespread during the entire data period.

3. Some sites started reporting to the MODS system part way through the time period. The creation of new facilities at new sites causes an additional site to be added to the MODS system. In addition, in Fiscal Year 1992 the Postal Service significantly expanded the coverage of the MODS system as about 200 more offices were added to the system.

With these considerations in mind, the data set was constructed as follows. Each record consists of all observations on all of the activities at a given site in a given time period. The first record or "row" of the data set is thus the values for hours and piece handlings at the first site in the first period in which it reported data. The second record of the data set contains the values for hours and piece handlings at the first site in the second period, and so on. When all of the data for the first site are included, the data from the second site are started. For example, if the first site has reported data to the MODS system for 65 accounting periods, the 66th record in the data set would be the data from all activities in the first accounting period that the second site reports.

Note that the data set is not "balanced" in the sense that all sites have the same amount of data or that all sites have data from the same accounting periods. In other words, the "maximum" amount of data, if all sites reported data in all accounting periods, is not the same for all activities. Library Reference H-148 provides a listing of the maximum number of observations potentially available for each activity. The maximum values are constructed by identifying the first AP that each site began reporting hours and piece handlings in each activity and cumulating the total number of observations across all sites from all eligible data periods. To provide a sense of the size of the data set, consider the following numbers. For the manual letter activity there are 29,711 potential observations from 446 sites and for the OCR activity there are potentially 21,805 observations from 311 sites.

There are several reasons why the analysis data set will be and should be smaller than the values for 'maximum' data sets presented in Library Reference H-148.

1. A site reports zero values for work hours or piece handlings in a given accounting period, after the activity is well established. Because these data are simply reporting omissions, they should be eliminated.

2. The site is just starting the activity and the work hour and piece handling data reflect a ramping up activity, not a normal operating environment. Data from these start-up periods should be eliminated.

Furthermore, to ensure high quality data for the panel data econometric exercise, two additional scrubs of the data are made. The first scrub requires that a site have at least thirty-nine continuous observations in any activity. The time dimension is an important part of the nature of panel data and if possible, it is preferable to have continuous data. Continuous data facilitate the estimation of accurate seasonal effects, secular non-volume trends, and serial correlation corrections. Because of the large amount of data available for this analysis, the loss in efficiency from dropping a small amount of data is outweighed by the gains in data quality associated with continuity. In addition, having a large data set allows me to require that each site have at least three years of data in an activity. While this is a relatively stringent standard, it ensures that there are sufficient data for accurately estimating seasonal effects and time trend effects.

In sum, any discontinuous links of data are dropped from the data set, ensuring that only continuous data are used in the econometric estimation. If a site does not have at least thirty-nine continuous observations in a particular activity, then data from the activity are not used in the econometric analysis. On rare occasions, a site will have more than one set of continuous data. This happens if there is a break in the data in the middle of the data set. When this occurs, the more recent continuous series with at least thirty-nine observations is selected.

A last scrub is applied because MODS is an operational data set. The fact that it is an operational data set has great value in the econometric analysis because the search for the cost generating process is based upon the actual data used for management decisions. Yet, it raises the possibility that, on occasion, the data may be misreported. To account for this possibility, the final scrub eliminates observations that imply extreme values, either high or low, for productivity. For the direct operations, this scrub works through the following steps:

Step 1. For each activity, the procedure calculates the ratio of hours to piece handlings for each site/accounting period observation. Note that this calculation is made on the data after they have been scrubbed for missing data or start-up periods.

Step 2: Next, the procedure forms the distribution of productivities, on an activity basis, from lowest to highest. It then finds the observations that constitute the one percent tails of the density on both ends of the distribution.

Step 3: The procedure then eliminates those observations that fall in the one percent tails by replacing the value of the observation with a missing data indicator.

Step 4: This elimination may, in some cases, cause a previously continuous series to become discontinuous. The procedure must then rerun the continuity scrub on the data after it has been put through the productivity scrub.

It may seem unusual that the data are scrubbed twice for continuity. However, the definition of "high" and "low" observations is influenced by the data set on which the standards are imposed. By first running an initial continuity scrub, the procedure establishes the right context for identifying productivity outliers. In addition, despite imposition of these relatively severe data scrubs, a large amount of "clean" data is left for estimating the econometric equations.

A slightly more rigorous scrub is run for the allied operations. Recall that the hours for an allied activity are regressed on separate TPH measures for the different sorting technologies. Thus, the allied scrub is based upon ensuring that continuous data exist for all sorting technologies. In addition, the allied productivity outlier scrub is based comparing the allied activity hours with all of the piece handlings from the sorting technologies. Because of the broad nature of the activities in the allied productivity scrub, when a one-percent outlier is identified, all data for that site are eliminated.

2. <u>The Productivity Information Reporting System is an operational data base that provides data on workload and hours for BMCs.</u>

Bulk Mail Centers do not report to the MOD system. Instead, they report to an alternative data system, the Productivity Information Reporting System (PIRS). PIRS is a national database covering all 21 BMCs and it reports hours for ten separate BMC activities. In addition, PIRS reports mail volume counts for seven sortation activities and the Bulk Business Mail Sack Opening activity. In parcel operations, PIRS reports the number of parcels sorted; in sack activities, it reports the number of sacks handled; and, in tray activities it reports the number of trays handled. PIRS also reports the number of pallets which are cross-docked.

Like the MOD system the PIR system is an operational data system. I therefore "scrubbed" the PIRS data in a manner similar to the scrub of the MODS data described above. The details of the scrubbing procedure are given in Library Reference H-148.

The PIRS data set is substantially smaller than the MODS data set because there are only 21 BMCs. In addition, my PIRS data set started in Fiscal Year 1989 rather than Fiscal Year 1988. The theoretical maximum amount of data possible for a BMC activity is 2,184 observations. However, not every BMC reports data for every activity for each accounting period. In addition, some observations are lost when the data are scrubbed. Nevertheless, there were sufficient data remaining after the scrubs for the estimation of eight BMC activity equations. For example, the mechanized sack sorting equation was estimated on 1,746 observations and the mechanized primary parcel equation was estimated on 1,877 observations.

3. The data available for estimating the registry and remote encoding equations are more limited.

The data for the remote encoding activity are more limited because it is a new operation. However, it currently has a material number of hours and the number of hours in the activity will grow as remote encoding becomes an even more integral part of the mail processing flow. Currently, data are only available from tracking reports starting in Fiscal Year 1996. The data set includes information on 198 sites over the period from Accounting Period 1 of Fiscal Year

1996 through Accounting Period 3 of Fiscal Year 1997. This structure could provide as many as 3168 observations if all sites were fully operational in all accounting periods.

Because the remote encoding activity is a new one, however, this is not the case. Many sites did not start reporting data until well into fiscal year 1996, and the amount of data which is available is much smaller at 1,898 observations.

Even less data are available for the registry activity. The volume data are taken from RPW which produces a single national number on a postal quarter basis. The hours data are taken from MODS and are available on an accounting period basis across sites for the period from Fiscal Year 1988 through Fiscal Year 1996. To match the hours data to the volume data, the hours are aggregated across all sites in each postal quarter.[12] The RPW data were collected for the Fiscal Year 1988 - Fiscal Year 1995 period. I thus have 32 observations available for estimating the registry equation.

C. Specifying the Functional Form.

To this point, I have determined the relevant variables and identified, collected, and cleaned the data. The next step is to specify the form of the relationship between the dependent variable, hours, and the explanatory variables.

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[12] The hours data are scrubbed like the other MODS data. See Library Reference H-148.

1. Specifying the functional form for the direct activities

In this instance, I do not have prior operational knowledge that guides my choice of functional form. I therefore follow the standard econometric practice of using a flexible functional form to approximate the true, but unknown functional form. The Commission has recommended this approach in the past.[13] Recall that hours is the dependent variable and that I have four right-hand-side variables, TPH, the manual ratio, and the two time trends. In the translog specification, I enter each of the right-hand-side variables with its log level and the square of its log level.

Finally, to facilitate the calculation of the cost elasticity, each of the variables is mean centered. Under this transformation, the cost elasticity or variability is just the first order term on TPH.

The specification of the econometric model is thus:

$$\begin{aligned}\ln HRS = {} & \left[\delta_1 + \delta_2 L\right] \ln TPH + \left[\delta_3 + \delta_4 L\right] (\ln TPH)^2 \\ & + \delta_5 \ln MANR + \delta_6 (\ln MANR)^2 + \delta_7 t_1 + \delta_8 t_1^{\,2} \\ & + \delta_9 t_2 + + \delta_{10} t_2^{\,2} + \delta_{11} [\ln TPH * \ln MANR] \\ & + \delta_{12} [\ln TPH * t_1] + \delta_{13} [\ln TPH * t_2] \\ & + \delta_{14} [\ln MANR * t_1] + \delta_{15} [\ln MANR * t_2] + \varepsilon \end{aligned} \tag{2}$$

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[13] See PRC Op., R87-1, App. J at 22.

In this specification, HRS represents hours, TPH represents total piece-handlings, the δ_i are estimated coefficients, L is the lag operator, MANR represents the manual ratio as defined above, t_1 is the time trend from FYAP 8801 though FYAP 9213, and t_2 is the time trend from FYAP 9301 through FYAP 9613. Note that the two time trends are the just two segments of a single overall trend and the equation should not include a cross-product between the two.

2. Specifying the functional form for the allied activities.

In the case of the allied activities, I capture the variation in hours by using piece handlings from all direct letter and flat sorting activities at the site. As discussed above, I use multiple right-hand-side variables, each representing the piece handlings in a particular letter or flat sorting technology. There are five different sorting technologies, so there are five distinct right-hand-side cost drivers. Finally, because I allow each technology to influence allied labor separately, I do not include the manual ratio term in the allied equations. The allied labor model specification is given by:

$$
\begin{aligned}
\ln HRS = & \left[\beta_1 + \beta_2 L\right] \ln TPH_{AL} + \left[\beta_3 + \beta_4 L\right] (\ln TPH_{AL})^2 \\
& + \left[\beta_5 + \beta_6 L\right] \ln TPH_{EL} + \left[\beta_7 + \beta_8 L\right] (\ln TPH_{EL})^2 \\
& + \left[\beta_9 + \beta_{10} L\right] \ln TPH_{ML} + \left[\beta_{11} + \beta_{12} L\right] (\ln TPH_{ML})^2 \\
& + \left[\beta_{13} + \beta_{14} L\right] \ln TPH_{EF} + \left[\beta_{15} + \beta_{16} L\right] (\ln TPH_{EF})^2 \\
& + \left[\beta_{17} + \beta_{18} L\right] \ln TPH_{MF} + \left[\beta_{19} + \beta_{20} L\right] (\ln TPH_{MF})^2 \\
& + \beta_{21} t_1 + \beta_{22} t_1^2 + \beta_{23} t_2 + + \beta_{24} t_2^2 \\
& \beta_{25} [\ln TPH_{AL} * \ln TPH_{EL}] + \beta_{26} [\ln TPH_{AL} * \ln TPH_{ML}] \\
& \beta_{27} [\ln TPH_{AL} * \ln TPH_{EF}] + \beta_{28} [\ln TPH_{AL} * \ln TPH_{MF}] \\
& \beta_{29} [\ln TPH_{EL} * \ln TPH_{ML}] + \beta_{30} [\ln TPH_{EL} * \ln TPH_{EF}] \\
& \beta_{31} [\ln TPH_{EL} * \ln TPH_{MF}] + \beta_{32} [\ln TPH_{ML} * \ln TPH_{EF}] \\
& \beta_{33} [\ln TPH_{ML} * \ln TPH_{MF}] + \beta_{34} [\ln TPH_{EF} * \ln TPH_{MF}] + \varepsilon
\end{aligned}
\qquad (3)
$$

In this equation, TPH_{AL} represents automated letter TPH, TPH_{EL} represents mechanized letter TPH, TPH_{ML} represents manual letter TPH, TPH_{EF} represents mechanized flat TPH, and TPH_{MF} represents manual flat TPH,

D. Choosing a Method of Estimation.

One of the strengths of panel data is that they allow for different methods of estimation of the above equation. In panel data estimation, there are three choices from which one can select a model: a pooled model, a fixed effects model, or a random effects model. In this section, I review each of the models and present econometric evidence, as well as reasoning, explaining why a fixed effects model is nest for my analysis.

In the pooled model, the researcher assumes that facility-specific characteristics are not important. If they are not, the panel data set is treated as being homogenous across facilities and the econometric equation is estimated by ordinary least squares (OLS). In its simplest form, the pooled model is illustrated by:

$$y_{it} = \alpha + \mathbf{x}_{it}\beta + \zeta_{it} \qquad \textbf{(4)}$$

Note that the variables are indexed by both the site at which the data were collected (i) and the time period in which the data were collected (j).

In the fixed effects model, this assumption of homogeneity across sites is relaxed. The fixed effects model allows for site-specific effects that would cause two facilities to have different levels of hours for the same amount of piece-handlings.[14] Reasons for these differences include things like the age of the facility, the quality of the local work force, and the quality of the mail that the facility must process. When there are facility-specific effects, the model must be modified to allow for these effects. In the fixed effects model, the pooled model is augmented in the following way:

$$y_{it} = \alpha_i^* + x_{it}\beta + \zeta_{it} \tag{5}$$

Now, α_i^* represents a vector of facility-specific effects that cause hours to vary across sites for the same amount of TPH. My experience in studying mail processing activities strongly suggests that there are significant non-volume variations across facilities. The ages and sizes of facilities vary widely across the postal network; some facilities are in urban areas others are not. In fact, in previous work I found that non-volume variations in facility characteristics have

[14] The fixed effects model allows for time-period-specific effects, as well as facility-specific effects. I have chosen to model the time-period-specific effects by the combination of autonomous time trends and seasonal dummies and thus do not use yet another set of the time-specific effects. I did, however, estimate the model allowing for time-period-specific effects and those results are discussed in Section IV, below. For clarity of presentation, the following technical discussion will omit discussion of time-specific effects.

an important impact on productivity.[15]

In determining the importance of site-specific effects, I did not have to rely solely upon judgment, however. There is a convenient test for the presence of facility specific-effects.[16] Consider again the simple pooled model:

$$y_{it} = \alpha + x_{it}\beta + \mu_{it}, \quad \textbf{(6)}$$

where the μ_{it} represent the OLS residuals. I perform the test for significant facility-specific effects through the estimation of a Gauss-Newton Regression (GNR):

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[15] See, Michael D. Bradley and Donald M. Baron, "Measuring Performance in A Multi-product Firm: An Application to the U.S. Postal Service," Operations Research. Vol.41, No. 3, May-June 1993. In this paper, we controlled for facility-specific effects by including facility-specific variables in the equation. The analysis, however, was at the facility-level not the activity level, so incorporating facility-specific variables was feasible. It is much more difficult to determine what facility-specific variables should be included in an equation at the activity level. Moreover, data on facility-specific characteristics at the activity level do not exist.

[16] See, Badi H. Baltagi, "Testing for Individual and Time Effects Using a Gauss-Newton Regression," Economics Letters, Volume 50, No. 2, February 1996, at pp. 189-92,

$$\tilde{\mu} = x\beta + \gamma\Gamma_1\tilde{\mu} + \omega,$$

$$\text{where: } \Gamma_1 = \frac{I_N \otimes I_T}{T}. \qquad (7)$$

When the original equation is linear, this is equivalent to a variable addition test:

$$y = x\beta + \gamma\Gamma_1\tilde{\mu} + \omega. \qquad (8)$$

Where the null hypothesis of no facility-specific effects is given by $\gamma = 0$. I can test this hypothesis with an ordinary t-test with a critical value of 1.96, and Table 4 presents the results of those tests. In every case, the GNR tests reject the null hypothesis, indicating that the facility-specific effects are important and that both the pooled and the simple cross-sectional models are not appropriate.

Table 4 GNR Tests for The Presence of Site-Specific Effects	
Activity	**Calculated t-statistic**
Manual Letters	217.31
Manual Flats	203.64
LSM	196.23
FSM	157.45
OCR	145.29
BCS	173.15
SPBS Non-Priority	78.04
SPBS Priority	38.57
Manual Priority	165.87
Manual Parcels	187.42
Cancellation & Meter Prep	199.72
Platform	325.14
Pouching	287.73
Opening - Pref	248.39
Opening - BBM	154.89

Having rejected the pooled model, the my last choice is between the fixed-effects model and the random effects model. As discussed above, the fixed effects model specifies that there are non-stochastic facility-specific characteristics that cause productivity to vary across facilities. Alternatively, one could model the facility-specific effects as random events. In the random effects model, the equation is specified as:

$$y_{it} = \alpha + x_{it}\beta + \eta_i + \zeta_{it}. \tag{9}$$

Here, the η_i represent the random facility-specific effects that are part of the error structure. A random effects regression can be estimated through generalized least squares (GLS) methods.

In choosing between fixed effects and random effects there are several important considerations. First, an important question is whether the regression analysis is intended to apply primarily to the facilities in the data set or whether it is intended to apply to a much broader set of facilities from which the current data were drawn randomly. If the answer is the former, as in the current analysis, then a fixed effects model is appropriate because the facility-specific effects are parametric.

A second consideration is the amount of data available. If there are relatively few data available, the random effects model may be preferred because it is more efficient and thus can make better use of limited data. In the current analysis, I have the advantage of having very large data sets, so the efficiency of the estimator is not a primary concern.

The final consideration is the most important. A key question is whether the facility specific effects are likely to be correlated with the right-hand-side variables. If so, the random effects estimator should not be used because it is biased. In the mail processing labor cost analysis, this correlation would occur if the facility-specific effects are correlated with TPH across sites.

I can test the existence of this correlation with the Hausman χ^2 test statistic. The test statistic is given by:

$$m_1 = \hat{\lambda}' \Sigma^{-1} \hat{\lambda} \sim \chi_k^2, \qquad (10)$$

where $\lambda = \beta_f - \beta_B$, β_f is from the fixed effects regression, β_B is from the "between" regression and $\Sigma = var(\lambda)$. Under the null hypothesis of no correlation, the value for the Hausman statistic is zero.[17]

I provide the Hausman statistics in Table 5. That table shows a general rejection the null hypothesis of no correlation.[18] Taken together, the empirical evidence produces a very strong case in favor of the fixed effects model and that is the method I use to estimate the econometric equations.

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[17] One drawback of the Hausman statistic is that Σ may not be positive definite in finite samples. If so, the test cannot be performed. This is the case for the equations for the two opening units.

[18] For the direct activity equations, the critical value for the chi-square statistic with 13 d.o.f. is 19.81 at the 90 percent level and 22.36 at the 95 percent level. Table 5 shows that the null hypothesis of no correlation can be rejected at the 95 percent critical value for all activities except for the SPBS-Priority activity and the null hypothesis can be rejected at the 90 percent critical value for that activity. For the allied activity equations, the critical value for the chi-square with 24 d.o.f. is 36.42. The null hypothesis is also rejected for those activities.

Table 5
Tests for The Correlation of Site-Specific Effects and Right-Hand-Side Variables

Activity	Calculated χ^2 statistic
Manual Letters	1012.77
Manual Flats	1404.99
LSM	296.73
FSM	219.68
OCR	309.41
BCS	155.69
SPBS Non-Priority	37.39
SPBS Priority	20.54
Manual Priority	410.17
Manual Parcels	182.15
Cancellation & Meter Prep	378.02
Platform	543.65
Pouching	907.42

Two econometric issues remain. Both deal with the time dimension of the data. The first remaining issue is the possibility of seasonal variations in the data. The Postal Service's Christmas peak is quite famous and one approach to seasonality would be to attempt to control just for this seasonal peak. Parsimonious specifications of seasonal patterns are typically adopted in an attempt to preserve degrees of freedom. When a relatively small amount of data is available, it is important to preserve degrees of freedom for estimating the key coefficient. One way to do this is through using relatively simple seasonal models.

However, different activities could have seasonal peaks at different points in the pre-Christmas season. Flats, for example, may have a peak before letters. In addition, there may be seasonal troughs in the summer for some activities. For these reasons, I apply a very general model of seasonality to each of the MODS direct activities but a more restricted specification to the MODS allied and the BMC activities. This difference arises because the MODS allied activities already have 34 right-hand-side variables and because the BMC activities have only about one-tenth of the data available for the MODS activities.

For the MODS direct activities, seasonal dummies for accounting periods two through thirteen are entered into each econometric equation. By using a general model of seasonality, I let the data for each activity describe where the seasonal peaks occur and identify their relative importance. For the MODS allied and BMC activities I enter two seasonal dummies, one for the Christmas season peak and one for the summer trough.

The last issue to be resolved before I estimate the econometric equations is serial correlation. Economic time series, particularly at relatively high frequencies, are generally characterized by serial correlation. Because of the time series dimension of panel data and because I have a relatively long time series by panel data standards, the probability of serial correlation is quite high in my data.

To test for the presence of serial correlation in a fixed effects model using panel data, I compute a modified version of the Durbin Watson statistic.[19] The fixed effect version of the Durbin Watson, which I term the BFN statistic is given by:

$$d_{BFN} = \frac{\sum_{i=1}^{N} \sum_{t=2}^{T} \left(\hat{u}_{it} - \hat{u}_{it-1}\right)^2}{\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{u}_{it}^{\,2}}, \qquad (11)$$

where the û are the residuals from the fixed effect regression.[20] The BFN statistics are presented in Table 6 and indicate the presence of serial correlation.[21]

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[19] See A. Bhargava, L. Franzini and W. Narendranathan, "Serial Correlation and the Fixed Effects Model," Review of Economic Studies, XLIX, 1982, at p. 533-549.

[20] Because the BFN statistic is calculated from the uncorrected fixed effects models, those models had to be estimated. They are alternative results that could be considered and are thus discussed in Section IV below.

[21] A value of the BFN statistic that differs from 2.0 indicates the presence of serial correlation. The lower bound for the 95 percent critical value is 1.554. All of the computed BFN statistics are below that value.

Table 6 Tests for The Presence of Serial Correlation	
Activity	**Calculated BFN statistic**
Manual Letters	.5133
Manual Flats	.4790
LSM	.5177
FSM	.4915
OCR	.3729
BCS	.3931
SPBS Non-Priority	.3715
SPBS Priority	.6356
Manual Priority	.4353
Manual Parcels	.3986
Cancellation & Meter Prep	.3481
Platform	.3467
Pouching	.2216
Opening - Pref	.2271
Opening - BBM	.2180

To correct for serial correlation, one must first estimate ρ, the serial correlation coefficient and then use that estimated coefficient to transform the data.[22] For each facility, I transform the first observation as:

[22] See A. Bhargava, L. Franzini and W. Narendranathan, "Serial Correlation and the Fixed Effects Model," Review of Economic Studies, XLIX, 1982, at page 539 or Cheng Hsiao, Analysis of Panel Data, Cambridge University Press, New York, 1986 at page 55.

$$\sqrt{1-\rho^2}\, y_{i1} = \sqrt{1-\rho^2}\, \alpha_i * + \sqrt{1-\rho^2}\, \beta x_{i1} + \xi_{i1} \qquad \textbf{(12)}$$

I transform all subsequent observations as:

$$(1-\rho L)\, y_{it} = (1-\rho)\, \alpha_i * + (1-\rho L)\, \beta x_{i1} + \xi_{it} \qquad \textbf{(13)}$$

where:

$$\varepsilon_{it} = \rho \varepsilon_{it-1} + \xi_{it} \qquad \textbf{(14)}$$

After I transform the data, I can apply the fixed effects method with the transformed means swept out of the data. This method is dependent, however, on the calculation of the serial correlation coefficient, ρ. Bhargava, Franzini and Narendranathan propose a method of calculation that has two drawbacks. First, it does not have a closed form solution, requiring computation through a search algorithm. Second, the solution tends to become unstable as the number of time periods in the data set increases. Because I have a relatively long time series, by panel data standards, the Bhargava, Franzini and Narendranathan formula may not be reliable. Therefore, I calculated ρ using the alternative formula presented by Baltagi and Li:[23]

[23] See, B.H. Baltagi and Q. Li, "A Transformation that will Circumvent the Problem of Autocorrelation in the Error Components Model," Journal of Econometrics, Vol. 48, pp. 385-393.

$$\rho = \sum_{i=1}^{N} \sum_{t=2}^{T} \frac{(\hat{\mu}_{it}\,\hat{\mu}_{it-1})}{\sum_{i=1}^{N} \sum_{t=1}^{T} \hat{\mu}_{it-1}^{2}} \qquad (15)$$

With this formula for ρ, I can make the correction for serial correlation and the results are presented in the next section.

Because of the limited data available, the panel data approach is not used for the registry regression and the remote encoding regression. The registry volume data are from RPW and are a national, quarterly time series. As discussed above, the registry hours are aggregated into a national time series by summing hours across all sites in each postal quarter. The registry equation is thus estimated with a time series regression.

The remote encoding data could be structured as a panel and as more data become available, a panel data estimator will be used. However, because I have less than one year of data for many sites, I choose to estimate this preliminary remote encoding equation as a simple constant elasticity pooled model rather than a fixed effects model translog model.

III. RESULTS FOR THE ECONOMETRIC EQUATIONS FOR MAIL PROCESSING ACTIVITIES.

In this section I discuss the results of the estimation of the econometric equations. Following long established econometric and Commission procedure, the data are mean centered before the econometric equations are estimated. This transformation permits convenient interpretation of the estimated coefficients. In a mean-centered equation, the effect of any explanatory variable on the dependent variable is captured by the first order term for that explanatory variable. Consequently, to interpret the econometric equations, I focus on the first order terms for each of the right-hand-side variables. Although complete econometric results are provided in my workpapers, the tables in this section give those first-order coefficients for the 25 equations that I estimated.

A. Econometric Results for MODS Direct Activities.

Table 7 presents the econometric results for the eleven equations that represent the MODS activities for which direct measures of piece-handlings exist. For each of those equations, the table lists the first-order term on current and lagged piece handlings, the manual ratio, and the two time trends.[24] A shaded box indicates that the estimated coefficient was not statistically

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[24] The manual ratio term is not entered into the equations for the parcel, priority, and canceling activities. These activities are not subject to the same diversion of mail from manual operations as in the letter and flat mail streams. For example, mail goes through the canceling activity whether it is ultimately bound for the OCR activity or the manual letter activity.

significant. The table also lists some statistics, like the number of observations, and the average piece handlings that describe the underlying data. The table also presents the estimated ρ, the coefficient of serial correlation, the standard error of the regression (S.E.R.) and the computed R^2. Because of the computational method of the fixed effects model, the R^2 statistic was calculated by its "analog" formula:[25]

$$R^2 = 1 - \frac{\sum e_{it}^2}{\sum (y_{it} - \bar{y}_{it})^2} \qquad \textbf{(16)}$$

Where the e_{it} are the residuals from the fixed effects regression. Note that the R^2 statistic was calculated with the residuals from the *uncorrected* model. I took this approach so as not to overinflate the apparent explanatory power of right-hand-side variables by crediting them with the explanatory power of the serial correlation coefficient, ρ.

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[25] For a discussion of this an other R^2 measures, see William H. Greene, Econometric Analysis, Macmillan Publishing Company, New York, 1993, at page 154.

Table 7
Econometric Results for MODS Sorting Activities

	Manual Letters	Manual Flats	OCR	BCS	LSM	FSM	SPBS Priority	SPBS Non-Priority	Manual Priority	Manual Parcels	Cancel & Mtr. Prep
Pieces	.7718	.7479	.6281	.7735	.8687	.7807	.6188	.3703	.4030	.3000	.5656
Lagged Pieces	.0254	.1184	.1582	.1715	.0360	.1376	.1827	.0983	.0449	.0952	.0886
Manual Ratio	-.1663	-.2494	[redacted]	.0467	-.0082	.0403	na	na	na	na	na
Time Trend 1	-.0011	[redacted]	-.0054	-.0023	-.0013	-.0010	[redacted]	.0037	.0031	.0038	.0038
Time Trend 2	.0008	[redacted]	.0059	.0019	.0034	.0052	[redacted]	.0031	.0116	[redacted]	[redacted]
ρ	0.737	0.754	0.810	0.798	0.731	0.749	0.676	0.810	0.776	0.794	0.822
S.E.R.	.0923	.0826	.01061	.0978	.0448	.0590	.2001	.1091	.1892	.2099	.0981
R^2	.9837	.9852	.9448	.9767	.9948	.9860	.8600	.8894	.9438	.8898	.9661
# of Obs.	24,781	23,989	18,497	22,737	19,734	17,943	1,967	4,569	15,736	17,345	19,557
# of Sites	309	300	234	287	239	219	30	63	201	234	253
Avg. Pieces (1,000s)	9,235	3,593	15,454	37,572	23,980	5,889	688	1,419	707	252	15,389
Elas.	0.797	0.866	0.786	0.945	0.905	0.918	0.802	0.469	0.448	0.395	0.654

The first order terms on the current piece-handling variables are large, and as my workpapers show, very precisely estimated.[26] This result confirms that the total piece-handlings variable is a good cost driver for mail processing labor costs. The coefficients on the lagged piece-handling terms are much smaller but still important in some cases. Because the Postal Service measure of volume variability is the response in cost to a sustained increase in volume, I add the current and lagged terms to calculate the elasticity. If volume rises by, say, 3 percent on a sustained basis, then piece-handlings would be higher in both the current and lagged periods. The total response is thus the sum of the two.

The most general result that I find is that the estimated variabilities are less than one. I find very little support for the Postal Service's old assumption of proportionality between costs and volume. Upon reflection, this result should not be surprising. There are several reasons why costs do not rise and fall in perfect proportion to the increases and decreases in volume.

The first reason is the existence of relatively fixed functions within the activity. Certain functions, like setting up mail processing equipment or tying

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[26] The precision of estimation can be expressed by the size of the confidence interval for the estimate coefficient. The smaller the standard error, the more precise the estimate. For example, the coefficient on piece handlings in the manual letters equation is 0.772 with a standard error of 0.00653. This provides a 99 percent confidence interval of 0.755 to 0.788.

down a manual case are done for each sorting scheme and are not sensitive to the amount of volume sorted. As volume rises, the hours in these functions do not rise much, if at all. Similarly, these hours do not fall when volume falls. The existence of these relatively fixed functions in an activity will cause the activity's variability to be less than one hundred percent. Moreover, the greater the degree of fixed functions in an activity, the lower its variability will be.

The second reason that variabilities are likely to be less than one is the classic division of labor and specialization. Increased specialization of tasks increases productivities and an increase in the size of an activity will allow for more coordination economies among the various tasks. For example, a large volume permits dedication of the same workers to an activity on a regular basis. This regularity increases their familiarity with the activity and, as a result, their efficiency. This type of economy seems most applicable to manual activities. As Adam Smith explained:[27]

> This great increase in the quantity of work which, in consequence of the division of labour, the same number of people are capable of performing is owing to three different circumstances; first to the increase in dexterity in every particular workman; secondly to the saving of the time which is commonly lost in passing from one species of work to another; and lastly, to the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many.

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[27] See, Adam Smith, An Inquiry into the Nature and Causes of the Wealth of Nations, March 9, 1776, Vol. 1, Book 1, at page 11.

In addition to the productivity gains associated with the division of labor, Smith mentions the impact of technological change on the methods of production. His reference to the "great number of machines" that "enable one man to do the work of many" is more commonly discussed as the effect of automation. In other words, the relationship between cost and volume depends, in part, on the technology used to sort that volume. For example, if mail in machine-paced activities is always sorted at the same speed, then adding more volume would just mean running the activity longer at the same speed. This type of production process would tend to have a high variability as any additional volume would always be sorted at the same rate as any preceding volume.

The physical technology is not the sole determinant of an activity's variability, however. A fourth reason why a variability may differ from one is the way in which the activity is used in the mail flow. In some cases, a particular activity may be used as a "gateway" activity. This means that the activity serves as an early recipient of mail in the mail flow. As such, it must be up and running and ready to receive mail as it comes into the stream. For example, the canceling activity serves as a gateway activity for mail flowing through all of the sorting technologies. In this activity, the mail is faced and canceled before it is set to other activities for sorting throughout the evening. Similarly, the OCR activity often serves as a gateway activity as mail is read and barcoded for later processing.

A gateway activity is therefore run at both low and high volumes and its piece productivity rises as volume rises. For this reason, gateway activities, like the OCR activity will have a lower variability than other types activities using the same physical technology. Activities in which the volume is "massed" prior to starting the activity will have higher variabilities.

A particular activity may also be used as a backstop technology. Much mail processing must be done within strict time limits set by dispatch times. Site managers will attempt to use the cheapest technology first to sort the mail, but as the dispatch time gets closer, they will use the backstop technology to ensure the mail meets its critical dispatch. In an automated environment, manual activities will serve as the backstop technology and these activities will be staffed so that they are available to sort the mail that cannot be finalized on automated equipment. In this way, the manual sorting activities serve as a form of insurance against service failures, but at the cost of lower piece productivity.[28] Productivity, in addition, will rise as volume rises and the activity is used more regularly. As volume rises or falls, the labor hours to do not rise and fall proportionately because of the reserve capacity characteristic of the activity. Activities that fill this role will tend to have lower variabilities.

Consistent with the above explanations, the estimated variabilities for three of the four machine-paced activities are over 90 percent. The high

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28 Be careful not to mistakenly interpret the low productivity in manual operation as implying an increase in total cost. The lower productivity in manual operations arises in the attempt to reduce total cost (through automation) while maintaining present service standards.

variabilities for the LSM, FSM, and BCS activities reflect both their technology of sorting and the way that those technologies are used. In the OCR activity, the gateway nature of the activity leads to a materially lower variability, despite the existence of a machine technology. Similarly, the variability for the canceling activity reflects its pivotal role and the primary gateway activity for each night's sorting.

The variabilities for the manual letter and flat variabilities are, on average, lower than those for the machine-based activities. These lower variabilities reflect the human component of the activities and their use as backstop technologies. It is important to note, though, that a lower variability does not necessarily imply a lower marginal cost. Recall that the variability measures the *percentage* response in cost to a given percentage change in volume. The variability reflects the *relative* unit costs of additional output as compared to the unit cost of current output. Because the average labor cost of a manual sort is much higher than the average labor cost of an automated sort (due to the lower productivity in manual operations), a lower manual variability does not imply that the marginal cost of a manual sort is below that of an automated sort.

While most of the sorting elasticities are 80 percent or above, three activities have relatively low variabilities. These activities are the SPBS non-Priority Mail activity, the manual Priority mail activity and the manual parcel sorting activity.

Because the manual Priority and parcel activities are manual activities, we would expect them to have relatively low variabilities. In addition, because they are relatively small activities, they have not yet achieved the economies associated with other manual activities.[29] This will lower the variability further. Finally, all sites must be prepared to sort parcels on a daily basis, even though volumes in these activities are low. Most sites, in addition, do not have a mechanized parcel sorting activity.[30] Thus, the manual parcel sorting activity serves as both a gateway activity and a reserve capacity activity. It is the combination of all these factors occurring in one activity that gives the activity its low variability. Finally, the SPBS non-Priority variability reflects the fact that this activity is a mechanical extension of the bundle sorting distribution part of the opening activity.

As anticipated, the manual ratio variable is large in absolute value and negative for both the manual letter activity and the manual flat activity. Recall that a decrease in the manual ratio means that mail is being diverted into automation. A negative coefficient signifies that a lower manual ratio will cause a higher level of hours for any volume of piece handlings in the manual activity. The negative coefficient can be interpreted as indicating that increased automation of the mail stream caused productivity, at a given volume level, to

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[29] The parcel sorting activities in MODS offices is small because of the relatively small size of the parcel mail stream and because most parcel sorting takes place in the BMCs.

[30] Only six MODS sites reported having the mechanized parcel sorting activity.

decline in manual activities. This is to be expected as the cleaner mail is diverted to automation, the "dirtier" or more difficult to sort mail remains in the manual activities. More difficult mail means lower productivity.

The manual ratio variable is much smaller in the mechanized and automated activities. In fact, the coefficient on the manual ratio term is not significantly different from zero in the OCR equation.

For the six letter and flat sorting activities, the broken time trend reveals that the hypothesis of two different trends is supported. Except for manual flats, which doesn't have a statistically significant trend in either period, the sign on the trend term switches from negative to positive. An autonomous decline in hours, in each of these activities, for the 1988-1992 period is replaced with an autonomous increase in hours for the 1993-1996.

B. Econometric Results for MODS Allied Activities.

Table 8 presents the econometric results for the four allied activities, the two opening activities, platform, and pouching. The format of Table 8 is similar to that of Table 7, except that the coefficients for both the current and lagged terms for each of the five piece-handling variables are listed.

All of the allied variabilities are substantially below 100 percent. Allied activities are the "mortar" that binds together the "bricks" of the direct piece sorting activities. Because they are all manual activities and because of their role as facilitating activities, I would expect allied activities to have variabilities which are, on average, below direct piece sorting activities. The platform activity is a good example of a support activity that has some basic functions that must be performed which are not highly correlated with volume. Mail handlers must be readily available to unload trucks at they come to the facility. The arrival of trucks is not perfectly predictable and is subject to peaking. The platform activity must therefore provide reserve capacity and this reserve capacity does not increase proportionately with volume.

All five of the piece-handling variables have explanatory power for the allied activities, revealing the general nature of these support activities. With the exception of the BBM opening unit, mechanized letter piece-handlings tend to have the largest elasticity and manual flats has the smallest. In the BBM opening unit, flats sorting, both mechanized and manual, are important drivers of this allied labor cost.

Despite the different roles played by the individual cost drivers in the opening units, the variabilities for the two opening units are quite close, with the two variabilities only two percentage points apart.

Table 8
Econometric Results for MODS Allied Activities

	Opening Pref.	Opening BBM	Platform	Pouching
Automated Letters	0.1043	0.0501	0.1157	0.0965
Mechanized Letters	0.2400	0.0933	0.2494	0.2654
Manual Letters	0.1093	0.1248	0.1275	0.1235
Mechanized Flats	0.0721	0.1659	0.0631	0.1207
Manual Flats	0.0806	0.1623	0.0372	0.0655
Lag Auto. Letters	0.0327	-0.0063	0.0574	0.0552
Lag Mech. Letters	0.0211	0.0587	-0.0089	0.0280
Lag Manual Letters	0.0070	0.0411	0.0247	0.0033
Lag Mech. Flats	0.0355	0.0475	0.0446	0.0316
Lag Manual Flats	0.0169	0.0032	0.0154	0.0388
Time Trend 1	-0.0010	-0.0014	-0.0009	0.0039
Time Trend 2	0.0013	0.0029	0.0079	0.0090
ρ	0.884	0.890	0.823	0.886
S.E.R.	.0915	.1532	.0801	.1243
R^2	.9488	.8583	.9791	.9474
# of Obs.	16,668	14,276	17,454	14,276
# of Sites	188	161	198	161
Avg. Hours	12,230	5,621	13,630	7,287
Elasticity	0.720	0.741	0.726	0.829

C. Econometric Result for BMC Sorting Activities.

The variabilities for BMC activities are also estimated on accounting period data but it is from PIRS, not MODs. The available data starts in fiscal year 1989 rather than in fiscal year 1988, like the MODS data. Given that there are only 21 BMCs, the available pool of data is much smaller than for the MODS activities. If every BMC reliably reported data for an activity in every possible time period, a maximum of 2,184 observations would be available. As with the MODS data, the PIRS data are operational data, not a special sample drawn for this study. I thus subjected them to the same scrubs I used on the MODS data.

After scrubbing, a substantial amount of data remained. For example, the mechanized sack sorting equation was estimated on 1,746 observations and the mechanized primary parcel equation was estimated on 1,877 observations.

I estimated equations for six BMC sorting activities, three that are mechanized and three that are manual. The pattern of the variabilities parallels that of the MODS activities with the mechanized variabilities in the high eighties or nineties and well above the manual ones.

Table 9
Econometric Results for BMC Sorting Activities

	Mechanized Sack Sorting	Mechanized Primary Parcel Sorting	Mechanized Secondary Parcel Sorting	NMOs	BBM Sack Opening	Irregular Parcel Post
Pieces	0.9679	0.8408	0.9577	0.7105	0.6487	0.7161
Lagged Pieces	0.0231	0.0172	0.0116	-0.0399	0.0691	0.0372
Time Trend 1	-0.0003	0.0002	0.0002	-0.0019	0.0012	0.0002
Time Trend 2	0.0048	0.0002	-0.0111	0.0044	-0.0074	0.0035
ρ	0.798	0.834	0.862	0.824	0.799	0.702
S.E.R.	0.051	0.059	0.064	0.081	0.089	0.114
R^2	.9343	.9173	.8155	.8866	.9564	.8877
# of Obs.	1,736	1,877	1,837	1,806	1,563	1,644
# of Sites	20	20	20	20	19	20
Avg. Pieces (1,000s)	1,844	5,680	3,383	643	293	444
Elasticity	0.991	0.858	0.969	0.671	0.718	0.753

D. Econometric Result for BMC Allied Activities.

I estimated econometric equations for two BMC allied activities. Like the MODS allied activities, the BMC allied activities support other distribution activities. Consequently, indirect measures of volume are used as the cost drivers.

The two allied activities in BMCs are the platform activity and the general floor labor activity which supports parcel sorting as well as other distribution activities. The platform activity has two cost drivers, Total Equivalent Pieces (TEP) and the cross docking of pallets. Both of these drivers have positive and significant impacts on platform hours and they combine in an overall variability of 53 percent.

The floor labor activity is driven primarily by parcel sorting so the mechanized parcel sorting activity and the IPP activity are entered as separate cost drivers. All other distribution activities are entered in a combined category. The two parcel activities contribute the majority of the variability with a variability for mechanized parcel sorting of 21.7 percent and for IPP sorting of 12.9 percent. When combined with the other activities the overall variability of floor labor is about 60 percent.

This is a slightly higher variability than appears in the Base Year. There, the floor labor variability is 53.7 percent. In the course of preparing my workpapers, I discovered that I had inadvertently omitted the mechanized sack sorting volume from the "other" volume category. I corrected this omission and re-estimated the equation. The corrected version appears in my workpapers and in Table 10.

Table 10
Econometric Results for BMC Allied Activities

Platform		Floor Labor	
Total Pieces	0.4594	Parcel Sorting	0.2174
Cross Dock	0.1128	IPP Sorting	0.1294
Lag Total Pieces	[redacted]	Other	0.2066
Lag Cross Dock	-0.0312	Lag Parcel Sorting	0.0633
		Lag IPP Sorting	[redacted]
		Lag Other	[redacted]
Time Trend 1	[redacted]	Time Trend 1	[redacted]
Time Trend 2	0.0038	Time Trend 2	[redacted]
ρ	0.8402	ρ	0.8471
S.E.R.	0.0594	S.E.R.	0.0947
R^2	0.8239	R^2	0.7188
# of Obs.	1,755	# of Obs.	1,639
# of Sites	20	# of Sites	19
Average Hours	18,017	Average Hours	54,168
Elasticity	0.526	Elasticity	0.604

E. Econometric Results for Activities Without Piece-Handling Measures.

I estimated variabilities for two MODS activities that to not have conventional piece-handling measures, the remote encoding activity and the registry activity.

As mentioned above, because of the recent origin of the operation and the short time span of data, I estimated a very simple pooled model for the remote encoding activity. The estimating equation regressed the log of the consol hours on the log of the number of images. The results of that estimation are given in Table 11. That table shows that the elasticity is virtually one hundred percent.[31]

Table 11 Econometric Results for the Remote Encoding Activity	
Images	1.005
R^2	.9758
# of Observations	1,898
# of Sites	198
Avg. Hours	11,754

[31] Experiments with higher order terms and a fixed effect models also yielded an elasticity that was close to one. These results are presented in Section IV, below.

The other activity for which an alternative cost driver was available was the registry activity. Here, the total registry hours for MODS offices were regressed against national RPW volumes for registry mail in a mean-centered, translog equation with a time trend and a dummy variable for the fourth quarter. (The fourth quarter contains four accounting periods, but the other quarters contain only three.) The econometric results are presented in Table 12. The estimated variability is quite low at 15.28 percent but this accords with general administrative nature of the registry activity. It is also close to the implicit variability used in the past; I am told that the percent of handling tallies in the IOCS registry cost pool historically has been around 15 percent.

Table 12
Econometric Results for the Registry Activity

Volume	0.1528
Time	-0.0022
R^2	.989
# of Observations	32
Avg. Quarterly Hours	841,235

IV. ALTERNATIVE ECONOMETRIC ANALYSES THAT I PERFORMED.

In this section, I describe the alternative econometric analyses that I performed in choosing the models that provide the variabilities that I am recommending to the Commission. For each alternative analysis, I identify differences between the alternative and the preferred model with respect to variable definitions, equation forms, or estimation results; provide the econometric results for the alternative; and discuss why the alternative is not preferred to the recommended model.

A. Econometric Equations Without A Serial Correlation Correction.

The first alternative to consider is quite close to the preferred model. In fact, this alternative is identical in terms of the variables used and the equation specification. The only difference is that this alternative presents the econometric results *before* the correction for serial correlation is applied.

My reason for presenting this alternative is straightforward. The uncorrected results must be estimated to calculate residuals necessary for forming the BFN panel data Durbin-Watson statistic. Thus, the results of the estimation of the uncorrected results influenced my choice of final models. Had the Durbin-Watson statistics not indicated the presence of serial correlation, the uncorrected results would have been leading candidates for the preferred model.

Table 13 presents the results of the uncorrected models. The results are generally similar to the corrected results, although the variabilities for the manual operations are a bit lower for the uncorrected results. The uncorrected variability for the OCR operation is a higher.

Table 13
Estimated Variabilities from the Model Uncorrected For Serial Correlation

Activity	Estimated Variability
Manual Letters	0.589
Manual Flats	0.624
LSM	0.909
FSM	0.997
OCR	0.937
BCS	1.006

These results are not preferred because the statistical tests strongly show the presence of serial correlation. The results that have been corrected for serial correlation are the appropriate ones because of the improved efficiency of the estimation.

B. Econometric Equations that Adjust for Time Specific Effects.

As discussed earlier in my testimony, an alternative approach to panel data estimation is to simultaneously correct for both site-specific and time-specific effects. Because of information about the nature of structural change in mail processing operations, I chose to model these time specific effects through a broken, non-linear trend.

To check this decision, I also estimated the panel data model using a correction for time-specific effects in place of the broken trend. Because this model simultaneously accounts for site-specific effects and time-specific effects, it is sometimes called the "two-way" model. The specification for this model thus includes TPH, a single unbroken time trend, the manual ratio and the seasonal dummy variables. The alternative model was estimated on the same mean-centered accounting period data as the preferred model and was corrected for serial correlation. The results of estimation are provided in Table 14.

Several characteristics of the results bear mention. First, the two-way variabilities are lower than the preferred model and in some cases the two-way variabilities are materially lower. Nevertheless, the general patterns found in the preferred model are confirmed here. The manual ratio variable, for example, is negative and large in absolute value in the manual operations and, positive and much smaller in the mechanized and automated operations.[32] In addition, the

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[32] Just as in the preferred model, the coefficient on the manual ratio is negative in the FSM equation.

manual variabilities are, on average, below the variabilities for the machine paced activities.

Although these results have some merit, I am not recommending them to Commission. I believe that the segmented time trend does a better job of capturing the time related non-volume effects on volume and that the higher variabilities estimated in the preferred model are more accurate. In particular, the results of the two-way model may be sensitive to the expansion of the data set when the approximately 200 additional offices started reporting in 1992.

Table 14 Econometric Results from Two-Way Panel Data Model						
	Manual Letters	Manual Flats	LSM	FSM	OCR	BCS
Piece Handlings	0.7498	0.7310	0.8683	0.7968	0.6328	0.8297
Manual Ratio	-0.1917	-0.2001	-0.0045	0.0184	0.0192	0.0524
Time	0.0020	0.0028	0.0009	0.0003	0.0027	0.0009
R2	0.7177	0.7471	0.9263	0.8733	0.5325	0.6779
# of Obs.	24,781	23,989	19,734	17,943	18,497	22,737
D.W.	0.4664	0.4392	0.5101	0.5200	0.3750	0.4265
ρ	0.7670	0.7803	0.7447	0.7394	0.8123	0.7867

C. Econometric Equations Estimated on Annual Data

To investigate if the estimated variabilities are a manifestation of using data at the accounting period frequency, I re-estimated the equations using annual data. The accounting period data for both hours and piece-handlings for each site were cumulated across the fiscal year in which they occurred. Thus, a site which reports accounting period data from Fiscal Year 1988 through Fiscal Year 1996 will have nine observations rather than 117 observations.

The use of annual data precludes adjusting for seasonal effects so the seasonal dummies are dropped from the model. In addition, each site will have no more than nine observations and many sites will have fewer. This small number of observations makes it impossible to estimate a reliable segmented trend. Instead, I used year-specific dummy variables, entering one for each year from Fiscal Year 1989 through Fiscal Year 1996. Finally, because of the small amount of data on the time dimension, it is not practical to include a lagged piece-handling term in the equation. The results of estimating the equation on annual data are given in Table 15.

Table 15 Econometric Results from the Model Estimated On Annual Data						
	Manual Letters	Manual Flats	LSM	FSM	BCS	OCR
Piece Handling	0.7317	0.7988	0.9471	1.0402	1.0031	0.9749
Manual Ratio	-0.2428	-0.1881	-0.0510	-0.0688	-0.0824	[redacted]
R2	0.9413	0.9478	0.9812	0.9670	0.8777	0.9502
ρ	0.3137	0.4055	0.3367	0.4639	0.3928	0.3299
# of Obs.	1,972	1,918	1,598	1,461	1,550	1,842
# of Sites	309	300	239	219	234	287

The results for the annual data are based upon substantially less data than the accounting period results. Nevertheless, the variabilities follow the same general pattern with the manual variabilities well below the variabilities for the machine-paced operations. The annual data provide elasticities that are lower for the manual operations but higher for the mechanized and automated operations.

The results based upon the annual data generally support the results from the AP data in the sense of replicating the pattern and magnitude of the estimated variabilities. The annual results are not preferred, however, because they are based upon substantially less data than the accounting period data and thus do not embody an effective way to capture non-volume time-related effects.

D. Econometric Results Based upon Same Period Last Year (SPLY) Data.

Another effort to check the robustness of the results based upon the accounting period data is the re-estimation of the model on "same-period-last-year" (SPLY) data. This SPLY model was estimated to check the hypothesis that the determinant of staffing for a mail processing activity in a given accounting period is its amount of volume growth over the same period in the previous year. Under this hypothesis, the hours are adjusted on a year-over-year basis in response to year-over-year changes in piece-handlings.

The SPLY model is estimated on accounting period data, but the SPLY ratio is inserted in place of the current value for each of the variables.[33] In addition, a SPLY model eliminates seasonal variations, so no seasonal dummies should be included. The SPLY model specifies that the year-over-year growth in the current accounting period's hours depend upon the year-over-year growth in volume. Because of the indirect inclusion of lagged piece handlings, no additional lag term is required. The SPLY model includes the manual ratio term and the two time trends. Table 16 presents the econometric results from the

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[33] The SPLY ratio is calculated by taking the current accounting period's value for hours (or volume) and dividing it by the value for hours (or volume) in the same accounting period in the previous year.

SPLY model.

The results from estimation on the SPLY data confirm the general result the variabilities are less than one and repeat the pattern that the variabilities for manual activities are below variabilities for mechanized and automated activities. The estimated variabilities are quite low, however.

The results based upon the SPLY data are not preferred because the SPLY results are generally inferior to the preferred model. The model does not do as good a job explaining variations in hours and suggests very low variabilities.

Table 16 Econometric Results from Estimating the Model on SPLY Data						
	Manual Letters	Manual Flats	LSM	FSM	OCR	BCS
Piece Handlings	0.5226	0.5263	0.8873	0.8266	0.7585	0.8419
Manual Ratio	-0.1136	0.0245	-0.0347	-0.0220	-0.0056	0.0038
Time Trend 1	-0.0017	0.0007	-0.0008	0.0005	-0.0030	-0.0021
Time Trend 2	0.0031	0.0001	0.0006	-0.0006	-0.0044	-0.0027
R2	0.477	0.589	0.929	0.663	0.500	0.621
# of Obs.	20,764	20,089	16,627	15,096	15,455	19,006
# of Sites	309	300	239	219	234	287

E. Econometric Results Accounting for Measurement Error.

When using operating data, there is always a concern that the data might contain measurement error. If the measurement error is in the dependent variable, hours, it will simply be part of the specified error term in the econometric regressions. If the measurement error is in the right-hand-side variables, however, traditional least-squares methods will not accurately account for it. This is called the "errors-in-variables" problem.

In general, this is a problem of unknown magnitude as traditional cross-sectional data do not provide any insight into the size or importance of the measurement error. The nature of the measurement error is typically not known and in cross-sectional data, investigating measurement error requires additional data or other information beyond the original sample.

One advantage of panel data, is that they permit direct investigation of the errors-in-variables problem. The measurement error will reveal itself in different ways in a panel data model, because the data can be subject to a number of transformations. By looking at the model from more than one perspective, an errors-in-variables estimator can be derived.

To see how a consistent, errors-in-variables model can be derived, consider the basic fixed effects model:[34]

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[34]This derivation is taken from Cheng, Hsaio, Analysis of Panel Data, Cambridge University Press, New York, 1986 at page 63.

$$y_{it} = \alpha_i^* + x_{it}\beta + \zeta_{it} \tag{17}$$

Where the y_{it} represent hours and the x_{it} represent piece handling volume. Suppose that the piece handling volume is measured with error so that the true volume is not observed. The data then contain observations that include both the true value for volume, x_{it}, and measurement error, ψ_{it}.

$$x^*_{it} = x_{it}\beta + \psi_{it}. \tag{18}$$

Under this condition, the fixed effects estimator is inconsistent, with the inconsistency arising from the variance of the measurement error. The source of inconsistency is made clear by looking at the probability limit of the fixed effects estimator as N, the number of sites, gets large:

$$plim\ \hat{\beta}_f = \beta\left[1 - \frac{(T-1)\sigma_\psi^2}{T\ Var(x_{it}^* - \overline{x_i^*})}\right]. \tag{19}$$

This shows that the fixed effects estimator will understate the true β when the variance of the measurement error is large. With panel data, an alternative approach to removing the site-specific effects is to first-difference the data. Under this approach, one regresses the one period change in hours on the one period change in piece-handling volume:

$$y_{it} - y_{i,t-1} \;=\; + \;(x_{it} - x_{i,t-1})\beta + (\zeta_{it} - \zeta_{i,t-1}) \qquad \textbf{(20)}$$

This estimator is also inconsistent and the form of its inconsistency is given by its probability limit:

$$plim\, \hat{\beta}_d \;=\; \beta\left[1 - \frac{2\,\sigma_{\psi}^{2}}{Var(x_{it}^{*} - x_{i,t-1}^{*})}\right] \qquad \textbf{(21)}$$

The advantage of panel data is now clear. We have two alternative estimators for β, each of which provides a formula for measuring the effects of the measurement error. By combining the formulas for the two estimators, we can derive a consistent estimator of β that is free from potential measurement error:[35]

$$\hat{\beta} \;=\; \left[\frac{2\,\beta_f}{Var(x_{it}^{*} - x_{i,t-1}^{*})} - \frac{(T-1)\,\beta_d}{T\,Var(x_{it}^{*} - \overline{x_i^{*}})}\right] \left[\frac{2}{Var(x_{it}^{*} - x_{i,t-1}^{*})} - \frac{(T-1)}{T\,Var(x_{it}^{*} - \overline{x_i^{*}})}\right]^{-1} \qquad \textbf{(22)}$$

[35] Having two estimators for β is like having two equations for one unknown. The two equations can be solved to find the unique value for β.

In the mail processing analysis, measurement error is of particular concern for the manual letter and flat operations, in which the mail is weighed to produce volume counts. In the mechanized and automated operations, the volume data are taken directly from machine counts and are not subject to material measurement error. To investigate the importance of measurement error for the mail processing labor cost equations, I estimate the errors-in-variables elasticity for the manual letter and manual flat activities.

To be sure that I was clearly identifying the measurement error in piece-handling volume, I performed the errors-in-variables analysis on a streamlined model. The lag terms, time trends, seasonal factors, and manual ratio terms are omitted from the specification. This yields a very simple specification in which the only possible source of measurement error is in the volume of piece-handlings.

I estimated the fixed effects model, the first difference model, and calculated the relevant variances. The individual results were entered into the above formula for the errors-in-variables estimator and the value for the elasticity was calculated. Table 17 contains the econometric results. That table shows that in both cases, the errors-in-variables estimator is very close to the fixed effects estimator. In the case of manual letters, the errors-in-variables estimate is about two percentage points below the fixed effects estimate and in the case of manual flats, the errors-in-variables estimate is about two percentage points above the fixed effects estimate. This means that measurement error in manual letter and flat piece handling volumes is not a critical problem for the estimation of cost elasticities for those activities.[36]

Table 17
Econometric Results for the Errors-in-Variables Analysis

	Manual Letter Sorting Activity	Manual Flat Sorting Activity
Fixed Effects β	0.6316	0.6824
$Var(x_{it}^* - \bar{x}_i^*)$	0.0716	0.0880
First Difference β	0.7232	0.5800
$Var(x_{it}^* - x_{i,t-1}^*)$	0.0326	0.0271
Errors-in-Variables β	0.6048	0.6999

F. Econometric Results for Alternative Remote Encoding Models.

The equation that I estimated for the remote encoding operation was quite simple. Its simplicity was dictated by the short time span of the collected data, not by a limited amount of data, per se. Future research will involve investigating more complex models. As a first step in future research, I

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[36] I repeated the exercise on a more complex specification including time trends and the manual ratio variable. The results were virtually the same with the errors-in-variables estimate for manual letters slightly above the fixed effects estimate and the errors-in-variables estimate for manual flats slightly below the fixed effects estimate for manual flats.

investigated the robustness of the results from the simple model. I did this in two ways. The first was to extend the model specification to include a higher order term, making it a translog model. I then estimated the translog using a pooled data approach. The second extension I performed was to estimate the translog model using a fixed effects model. The results of these two extensions are given in Table 18.

Table 18
Econometric Results for Alternative Models of the Remote Encoding Activity

	Pooled Model	**Fixed Effects Model**
Images	1.0183	0.9859
$Images^2$	0.0231	0.0278

Table 18 shows that pooled translog model produces a slightly higher variability than the simple model. It also shows that the fixed effects translog model produces a variability that is slightly lower. Thus, the simple model seems to be an appropriate starting point for the variability in this activity, but as time passes and more data become available, a more sophisticated model should be explored.

V. FINDING PROXY VARIABILITIES FOR MAIL PROCESSING ACTIVITIES THAT DO NOT HAVE WORKLOAD MEASURES.

To have complete coverage of all mail processing labor costs, Witness Degen was required to form cost pools for certain activities that have no recorded workload measures. Nevertheless, he requires volume variabilities for these cost pools to be able to accurately identify product-specific volume variable costs. In this section I present the recommendations that I made for choosing proxy variabilities for these pools.

Because there are no recorded workload measures for these activities, I cannot estimate cost elasticities econometrically. The absence of workload measures, however, in no way supports an assumption of proportionality of costs to volume. In fact, the overwhelming result of the econometric analysis is that a volume variability of 100 percent is the exception rather than the rule. Thus, the arbitrary selection of 100 percent volume variability is no more defensible than the arbitrary selection, to pick a number at random, of a 28.6 percent volume variability.

When estimating a variability is impossible, the next best approach is to use the "best information available." For those cost pools without recorded workload measures, the best information available for approximating their variability is an estimated variability from a similar activity. There are four types of situations that require a proxy variability:

1. General Support Activities.
2. Mail Processing Activities Without Recorded TPH
3. Customer Service Activities
4. Non-MODS Activities

The choice of proxy variabilities for each of these types of activities is discussed below.

A. General Support Activities.

The first set of activities without a workload measure includes activities that provide facility wide support for a range of mail processing activities. The costs in these general support activities are not linked to any particular direct mail processing activities and there is no individual proxy that is appropriate. Because of their general nature, the costs in these activities are assumed to vary with variation in general mail processing hours. This requires applying the "system" variability to these activities.

The system variability measures, on average, how mail processing hours vary with volume. It is calculated as the hours-weighted average of all the econometrically estimated variabilities.[37] It is applied to the four general support cost pools: mail processing support, miscellaneous mail processing activities, empty equipment, and damaged parcel rewrap.

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[37] The details of the calculation of the system variability are provided in Exhibit 14B.

B. Mail Processing Activities Without Recorded Piece-Handlings.

Hours but not TPH are recorded through the MODS system for this group of activities. Econometric estimation of a variability is thus impossible.[38] To find a proxy variability, discussions were held with mail processing activities experts. These discussions led to a consensus selection of a proxy activity that satisfied two criteria: it had an estimated variability and it was similar to the activity being proxied. Table 19 provides a listing of each of this type of activity and the recommended proxy variability.

Table 19
Proxy Variabilities for Mail Processing Activities Without Recorded Piece Handlings

Activity That Requires a Proxy Variability	Activity Providing the Proxy Variability
Mechanized Sack Sorting	BMC Mechanized Sack Sorting
Mechanized Parcel Sorting	BMC Mechanized Parcel Sorting
Bulk Presort	Opening Units
Manual Sack Sorting	BMC Platform
Mailgram Sorting	Manual Letter Sorting
Express Mail Sorting	Manual Priority Mail Sorting
ACDCS (Scanning)	Pouching
Business Mail Reply/Postage Due	Manual Letter Sorting

[38] In one case, the mechanized parcel activity, TPH were recorded. However, only six MODS sites reported having this activity and they do not generate sufficient data to permit accurate estimation of a cost elasticity. A proxy, the mechanized parcel activity in BMCs, was thus used.

C. Customer Service Activities.

The third set of activities is similar to activities for which I have estimated cost elasticities, but they are not part of the main mail processing flow at distribution centers. These activities are considered "customer service" activities and the MODS system does not record TPH counts. In some cases, these activities are virtually the same as those in the distribution centers and the variability from the corresponding MODS activity can be directly applied. In other cases, a proxy variability must be used. Table 20 presents the list of customer service activities requiring a variability and the recommended proxy.

Table 20 Proxy Variabilities for Customer Service Activities	
Activity That Requires a Proxy Variability	**Activity Providing the Proxy Variability**
Automated Sorting at Stations and Branches	OCR & BCS Activities
Mechanized Sorting at Stations and Branches	LSM & FSM Activities
Manual Sorting at Stations and Branches	Manual Letter and Manual Flat Activities
Box Section Sorting at Stations and Branches	Manual Letter and Manual Flat Activities
Express Mail Sorting at Customer Service Offices	Manual Priority Mail Sorting
Special Service Activities at Customer Service Offices	Registry Activity
Miscellaneous Activities at Customer Service Offices	Registry Activity
Mail Markup and Forwarding	Average of Mechanized Activities
Business Mail Entry	Platform Activity

D. Non MODS Offices.

There is currently no system for recording hours and piece-handlings for individual activities in non-MODS offices. Because detailed information about the activities taking place in non-MODS offices is not available, the average or system variability from MODS offices will be applied to the overall mail processing costs for non-MODS offices.

EXHIBIT USPS-14A
MODS OPERATION NUMBERS

This exhibit presents a Postal Service update to Handbook M-32, Management Operating Data System. This update presents a recent listing of three-digit MODS operating codes and their descriptions.

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
	OPERATIONS SUPPORT	FUNCTION 0	
581	INDUSTRIAL ENGINEER		03
582	QUALITY IMPROVEMENT		02
593	ENVIRONMENTAL MANAGEMENT	01	07
594	ZIP+4 ADDRESS INFO SYSTEM	01	04
595	CRIS ADDRESS INFO SYSTEM	01	04
596	5 DIGIT ZIP INFO SYSTEM		04
645	PRODUCTION PLANNING		05
646	DELIVERY & RETAIL ANALYST		09
668	ADMIN & CLERICAL - OPERATIONS SUPPORT		08
672	ADMIN & CLERICAL - PRODUCTION PLANNING		05
673	ADMIN & CLERICAL - INDUSTRIAL ENGINEERING		03
674	ADMIN & CLERICAL - ADDRESS MANAGEMENT SYSTEM		04
675	ADMIN & CLERICAL - DELIVERY & RETAIL PROGRAMS		09
900	TRAVEL - OPERATIONS SUPPORT	01	08
920	MANAGER, OPERATIONS PROGRAMS SUPPORT	01	
922	MANAGER, IN-PLANT SUPPORT	01	
924	MANAGER, ADDRESS SYSTEMS	01	
	MAIL PROCESSING	FUNCTION 1	
002	PRESORT PREF-CARRIER		17
003	PRESORT BULK-CARRIER/SATURATION		17
004	PRESORT PREF-3/5 DIGIT		17
005	PRESORT BULK-3/5 DIGIT/BASIC		17
006	PRESORT PREF-ZIP+4		17
007	PRESORT BULK-ZIP+4		17
008	PRESORT PREF-ZIP+4 BARCODED		17
009	PRESORT BULK-ZIP+4 BARCODED		17
010	HAND CANCELLATIONS		17
011	MICRO MARK		17
012	M - 36		17
013	MARK II/HALF MARK		17
014	FLYER		17
015	ADVANCED FACER CANCELLER SYSTEM		17
016	FLAT CANCELLATIONS		17
017-019	ALLIED LABOR - CANCELLATIONS		17
020-028	MAIL PREPARATION-METERED		17
020B	MAIL PREPARATION-METERED BYPASS		17
029	RIFFLE LETTER MAIL		14
030	MANUAL LTR-OUTGOING PRIMARY		14
032	MANUAL LTR-INTERNATIONAL OUTBOUND		14
033	MANUAL LTR-INTERNATIONAL INBOUND		14
040	MANUAL LTR-OUTGOING SECONDARY		14
043	MANUAL LTR-STATE DISTRIBUTION		14
044	MANUAL LTR-SCF DISTRIBUTION		14
045	MANUAL LTR-BULK BUSINESS		14
050	PRIORITY - MANUAL, OUTGOING		14
055	PRIORITY - MANUAL, INCOMING		14
060	MANUAL FLT-OUTGOING PRIMARY		14
062	MANUAL FLT-INTERNATIONAL OUTBOUND		14
063	MANUAL FLT-INTERNATIONAL INBOUND		14
069	RIFFLE FLAT MAIL		14
070	MANUAL FLT-OUTGOING SECONDARY		14
073	MANUAL FLT-STATE DISTRIBUTION		14

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
074	MANUAL FLT-SCF DISTRIBUTION		14
075	MANUAL FLT-BULK BUSINESS		14
081	MPLSM-OUTGOING PRIMARY		12
082	MPLSM-OUTGOING SECONDARY		12
083	MPLSM-MANAGED MAIL		12
084	MPLSM-SCF		12
085	MPLSM-INCOMING PRIMARY		12
086	MPLSM-INCOMING SECONDARY		12
087	MPLSM-BOX SECTION		12
088	MPLSM-BAR CODE READ, OUTGOING		12
089	MPLSM-BAR CODE READ, INCOMING		12
090	LSM-INTERNATIONAL INBOUND		12
091	SPLSM/DBCS KEYING-OUTGOING		12
092	LSM-INTERNATIONAL OUTBOUND		12
093	SPLSM/DBCS KEYING-MANAGED MAIL		12
094	SPLSM/DBCS KEYING-SCF		12
095	SPLSM/DBCS KEYING-INCOMING PRIMARY		12
096	SPLSM/DBCS KEYING-INCOMING SECONDARY		12
097	SPLSM/DBCS KEYING-BOX SECTION		12
098	SPLSM BAR CODE READ, OUTGOING		12
099	SPLSM BAR CODE READ, INCOMING		12
100	MANUAL PARCELS-OUTGOING		14
102	MANUAL PARCELS-INTERNATIONAL OUTBOUND		14
103	MANUAL PARCELS-INTERNATIONAL INBOUND		14
105	MECHANIZED PARCEL SORTER		13
107	PARCEL SORTER-INTERNATIONAL OUTBOUND		13
108	PARCEL SORTER-INTERNATIONAL INBOUND		13
109	DAMAGED PARCEL REWRAP		18
110-114	OPENING UNIT-OUTGOING,PREF		17
115-117	OPENING UNIT-OUTGOING,BBM		17
118	ACDCS OUTGOING		17
119	ACDCS INCOMING		17
120-129	POUCHING OPERATIONS		17
130	MANUAL PARCELS-SCF		14
131	EXPRESS MAIL DISTRIBUTION		18
132	INTELPOST		18
134	SPBS OUTGOING PREF		13
135	SPBS OUTGOING BBM		13
136	SBPS INCOMING PREF		13
137	SPBS INCOMING BBM		13
138	SPBS-PRIORITY, OUTGOING		13
139	SPBS-PRIORITY, INCOMING		13
141	MPFSM-OUTGOING PRIMARY		12
142	MPFSM-OUTGOING SECONDARY		12
143	MPFSM-MANAGED MAIL		12
144	MPFSM-SCF		12
145	MPFSM-INCOMING PRIMARY		12
146	MPFSM-INCOMING SECONDARY		12
147	MPFSM-BOX SECTION		12
148	MPFSM-INCOMING NON-SCHEME		12
150	MANUAL LTR-INCOMING PRIMARY		14
160	MANUAL LTR-INCOMING SECONDARY		14
168	MANUAL LTR-PRIMARY BOX		14
169	MANUAL LTR-SECONDARY BOX		14
170	MANUAL FLT-INCOMING PRIMARY		14
175	MANUAL FLT-INCOMING SECONDARY		14
178	MANUAL FLT-PRIMARY BOX		14

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
179	MANUAL FLT-SECONDARY BOX		14
180-184	OPENING UNIT-INCOMING,PREF		17
185-189	OPENING UNIT-INCOMING,BBM		17
191	SPFSM-OUTGOING PRIMARY		12
192	FSM-INTERNATIONAL OUTBOUND		12
193	FSM-INTERNATIONAL INBOUND		12
194	SPFSM-SCF		12
195	SPFSM-INCOMING PRIMARY		12
196	SPFSM-INCOMING SECONDARY		12
197	SPFSM-BOX SECTION		12
200	MANUAL PARCELS-INCOMING		14
210-229	PLATFORM LOAD/UNLOAD		17
230-234	PLATFORM MISCELLANEOUS		17
235-237	MANUAL SORT-SACKS/OUTSIDES		17
238-239	MECHANIZED SORT-SACKS/OUTSIDES		13
291	CS BCS-OUTGOING PRIMARY		11
292	CS BCS-OUTGOING SECONDARY		11
293	CS BCS-MANAGED MAIL		11
294	CS BCS-INCOMING SCF		11
295	CS BCS-INCOMING PRIMARY		11
296	CS BCS-INCOMING SECONDARY		11
297	CS BCS-BOX SECTION		11
298	CS BCS-SECTOR/SEGMENT, 1ST PASS		11
299	CS BCS-SECTOR/SEGMENT, 2ND PASS		11
340	STANDBY - MAIL PROCESSING		18
341	QWL COORDINATOR-NONSUPERVISOR EMPLOYEES		18
342	QWL COORDINATOR-SUPERVISOR EMPLOYEES	10	
343	OPENING UNIT-INTERNATIONAL OUTBOUND		17
344	OPENING UNIT-INTERNATIONAL INBOUND		17
345	POUCHING - INTERNATIONAL		17
346	SPBS INTERNATIONAL OUTBOUND		13
347	SPBS INTERNATIONAL INBOUND		13
348	MANUAL SACK SORT-INTERNATIONAL		17
349	MECH SACK SORT-INTERNATIONAL		13
350	OVERLABEL/DIRECT AO SACK - INTERNATIONAL		17
351	PLATFORM - INTERNATIONAL		17
352	LOAD/UNLOAD AT PIERS - INTERNATIONAL		17
441	FSM1000-OUTGOING PRIMARY		12
442	FSM1000-OUTGOING SECONDARY		12
443	FSM1000-MANAGED MAIL		12
444	FSM1000-SCF		12
445	FSM1000-INCOMING PRIMARY		12
446	FSM1000-INCOMING SECONDARY		12
447	FSM1000-BOX SECTION		12
448	FSM1000-INCOMING NON-SCHEME		12
454	CODE/BILL/DISPATCH-INTERNATIONAL		17
545	FOREIGN MAILS		18
546	FOREIGN MAILS		18
547	SCHEME EXAMINERS		18
548	DETAIL-MAIL ORDER/PUBLISHING HOUSE		18
549	EMPTY EQUIPMENT PROCESSING		18
554-555	OFFICE WORK & RECORDKEEPING-MAIL PROCESSING		18
560-564	MISC ACTIVITY-MAIL PROCESSING		18
573	SHORT PAID & NIXIE - INTERNATIONAL		18
574	REPAIR & REWRAP-INTERNATIONAL		18
575	SURFACE AIRLIFT & EXPRESS MAIL - INTERNATIONAL		18
576	EMPTY EQUIPMENT-INTERNATIONAL		18

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
577	PREP & VERIFY DELIVERY BILLS - INTERNATIONAL		18
578	REGISTERED MAIL/DIPLOMATIC POUCHES - INTERNATIONAL		18
580	INSURED & RETURNED PARCELS - INTERNATIONAL		18
584	MAILGRAM		18
585-590	REGISTRY SECTION		18
607	STEWARDS - CLERKS - MAIL PROCESSING		18
612	STEWARDS-MAIL HANDLER-MAIL PROCESSING		18
620	TRAVEL - MAIL PROCESSING	10	18
630	MEETING TIME - MAIL PROCESSING	10	18
669	EXPRESS MAIL DISTRIBUTION		18
677	ADMIN & CLERICAL - PROCESSING & DISTRIBUTION		18
681	ADMIN & CLERICAL - PROCESSING & DIST, INTERNATIONAL		18
698	SUPERVISOR, AUTOMATION-MP	10	
699	SUPERVISOR, MECHANIZATION-MP	10	
700	SUPERVISOR, MANUAL-MP	10	
701	SUPERVISOR, OTHER DIRECT-MP	10	
702	SUPERVISOR, INDIRECT-MP	10	
755	DELIVERY BCS SERVICING		18
770	SUPERVISOR, RBCS SYSTEMS ADMINISTRATOR	10	
771	RBCS CONTRACTING OFFICERS REPRESENTATIVE		15
774	RBCS AUDIT MODULE		15
775	RBCS KEYING		15
776	LETTER MAIL LABELING MACHINE		15
779	RBCS GROUP LEADER		15
793	EXPRESS MAIL DISTRIBUTION		18
798	MISCODED/UNCODED MAIL		18
831	MLOCR - OUTGOING PRIMARY		11
832	MLOCR - OUTGOING SECONDARY		11
833	MLOCR - MANAGED MAIL		11
834	MLOCR - INCOMING SCF		11
835	MLOCR - INCOMING PRIMARY		11
836	MLOCR - INCOMING SECONDARY		11
837	MLOCR - BOX SECTION		11
841	CRIS OCR-OUTGOING PRIMARY		11
842	CRIS OCR-OUTGOING SECONDARY		11
843	CRIS OCR-MANAGED MAIL		11
844	CRIS OCR-INCOMING SCF		11
845	CRIS OCR-INCOMING PRIMARY		11
846	CRIS OCR-INCOMING SECONDARY		11
847	CRIS OCR-BOX SECTION		11
851	SLOCR-OUTGOING PRIMARY		11
852	SLOCR-OUTGOING SECONDARY		11
853	SLOCR-MANAGED MAIL		11
854	SLOCR-INCOMING SCF		11
855	SLOCR-INCOMING PRIMARY		11
856	SLOCR-INCOMING SECONDARY		11
857	SLOCR-BOX SECTION		11
861	BCS ON OCR-OUTGOING PRIMARY		11
862	BCS ON OCR-OUTGOING SECONDARYY		11
863	BCS ON OCR-MANAGED MAIL		11
864	BCS ON OCR-INCOMING SCF		11
865	BCS ON OCR-INCOMING PRIMARY		11
866	BCS ON OCR-INCOMING SECONDARY		11
867	BCS ON OCR-BOX SECTION		11
868	BCS ON OCR-SECTOR/SEGMENT, 1ST PASS		11
869	BCS ON OCR-SECTOR/SEGMENT, 2ND PASS		11
871	MPBCS-OUTGOING PRIMARY		11

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
872	MPBCS-OUTGOING SECONDARY		11
873	MPBCS-MANAGED MAIL		11
874	MPBCS-INCOMING SCF		11
875	MPBCS-INCOMING PRIMARY		11
876	MPBCS-INCOMING SECONDARY		11
877	MPBCS-BOX SECTION		11
878	MPBCS-SECTOR/SEGMENT, 1ST PASS		11
879	MPBCS-SECTOR/SEGMENT, 2ND PASS		11
881	MLOCR-ISS-OUTGOING PRIMARY		11
882	MLOCR-ISS-OUTGOING SECONDARY		11
883	MLOCR-ISS-MANAGED MAIL		11
884	MLOCR-ISS-INCOMING SCF		11
885	MLOCR-ISS-INCOMING PRIMARY		11
886	MLOCR-ISS-INCOMING SECONDARY		11
887	MLOCR-ISS-BOX SECTION		11
891	DBCS-OUTGOING PRIMARY		11
892	DBCS-OUTGOING SECONDARY		11
893	DBCS-MANAGED MAIL		11
894	DBCS-INCOMING SCF		11
895	DBCS-INCOMING PRIMARY		11
896	DBCS-INCOMING SECONDARY		11
897	DBCS-BOX SECTION		11
898	DBCS-SECTOR/SEGMENT, 1ST PASS		11
899	DBCS-SECTOR/SEGMENT, 2ND PASS		11
910	CS BCS - DELIVERY POINT SEQUENCE, 1ST PASS		11
911	CS BCS - DELIVERY POINT SEQUENCE, 2ND PASS		11
914	MPBCS - DELIVERY POINT SEQUENCE, 1ST PASS		11
915	MPBCS - DELIVERY POINT SEQUENCE, 2ND PASS		11
916	BCS-OSS - DELIVERY POINT SEQUENCE, 1ST PASS		11
917	BCS-OSS - DELIVERY POINT SEQUENCE, 2ND PASS		11
918	DBCS - DELIVERY POINT SEQUENCE, 1ST PASS		11
919	DBCS - DELIVERY POINT SEQUENCE, 2ND PASS		11
927	MANAGER, DISTRIBUTION OPERATIONS	10	
928	SUPERVISOR, DISTRIBUTION OPERATIONS	10	
930	BUSINESS REPLY/POSTAGE DUE		18
932	SUPERVISOR, INTERNATIONAL	10	
961	FMBCR-OUTGOING PRIMARY		12
962	FMBCR-OUTGOING SECONDARY		12
963	FMBCR-MANAGED MAIL		12
964	FMBCR-INCOMING SCF		12
965	FMBCR-INCOMING PRIMARY		12
966	FMBCR-INCOMING SECONDARY		12
967	FMBCR-BOX SECTION		12
971	BCS-OSS-OUTGOING PRIMARY		11
972	BCS-OSS-OUTGOING SECONDARY		11
973	BCS-OSS-MANAGED MAIL		11
974	BCS-OSS-INCOMING SCF		11
975	BCS-OSS-INCOMING PRIMARY		11
976	BCS-OSS-INCOMING SECONDARY		11
977	BCS-OSS-BOX SECTION		11
978	BCS-OSS SECTOR/SEGMENT, 1ST PASS		11
979	BCS-OSS SECTOR/SEGMENT, 2ND PASS		11

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
	DELIVERY SERVICES	FUNCTION 2	
354	STANDBY - DELIVERY SERVICE	20	21
613	STEWARDS - CARRIERS		21
614	STEWARDS - SPECIAL DELIVERY MESSENGER		24
622	TRAVEL - DELIVERY SERVICES	20	21
632	MEETING TIME - DELIVERY SERVICES	20	21
705	MANAGER/SUPERVISOR - DELIVERY SERVICES	20	
707	MANAGER/SUPERVISOR - ROUTE EXAMINATION	20	
708	MANAGER/SUPERVISOR - OTHER DELIVERY/CUST SERV	20	
709	ROUTERS		29
710	ROUTERS		29
711	ROUTERS		29
713	VIM ROUTE - STREET	20	22
714	VIM ROUTE - OFFICE	20	21
715	2-TRIP BUSINESS - STREET	20	22
716	2-TRIP BUSINESS - OFFICE	20	21
717	1-TRIP BUSINESS - STREET	20	22
718	1-TRIP BUSINESS - OFFICE	20	21
719	RESIDENTIAL FOOT-STREET	20	22
720	RESIDENTIAL FOOT-OFFICE	20	21
721	RESIDENTIAL MOTOR-STREET	20	22
722	RESIDENTIAL MOTOR-OFFICE	20	21
723	2TRIP MIXED FOOT-STREET	20	22
724	2TRIP MIXED FOOT-OFFICE	20	21
725	2TRIP MIXED MOTOR-STREET	20	22
726	2TRIP MIXED MOTOR-OFFICE	20	21
727	1TRIP MIXED FOOT-STREET	20	22
728	1TRIP MIXED FOOT-OFFICE	20	21
729	1TRIP MIXED MOTOR-STREET	20	22
730	1TRIP MIXED MOTOR-OFFICE	20	21
731	COLLECTION STREET	20	27
732	COLLECTIONS OFFICE	20	27
733	PARCEL-POST-STREET	20	23
734	PARCEL-POST-OFFICE	20	23
735	RELAY-STREET	20	23
736	RELAY-OFFICE	20	23
737	COMBINATION-STREET	20	23
738	COMBINATION-OFFICE	20	23
739	CARRIER DRIVERS - STREET	20	23
740	CARRIER DRIVERS - OFFICE	20	23
743	CARRIER CUSTOMER SUPPORT ACTIVITIES		26
744	SPECIAL DELIVERY MESSENGER	20	24
757	CITY EMPLOYEE ON RURAL ROUTES		25
768	CITY CARRIER - TERTIARY DISTRIBUTION		28

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
	MAINTENANCE	FUNCTION 3	
615	STEWARDS - VMF		31
616	STEWARDS - MTE		39
617	STEWARDS - MVS		31
624	TRAVEL - PLANT & EQUIPMENT	35	39
634	MEETING TIME - PLANT & EQUIPMENT	35	39
647	VOMA SUPPORT		33
676	ADMIN & CLERICAL - MAINTENANCE SUPPORT	35	
679	ADMIN & CLERICAL - TRANSPORTATION & NETWORKS	30	31
680	ADMIN & CLERICAL - PLANT & EQUIPMENT		39
745	MAINTENANCE OPERATIONS SUPPORT		39
746	TELEPHONE SWITCHBOARD		39
747-749	BUILDING SERVICES		38
750-752	POSTAL OPERATING EQUIPMENT		36
753-754	BUILDING SYSTEMS EQUIPMENT		37
758	MANAGER, TRANSPORTATIONS & NETWORKS	30	
759	SUPERVISOR, TRANSPORTATION OPERATIONS	30	
760	MANAGER, VEHICLE MAINTENANCE	30	
761	REPAIR-GENERAL MAINTENANCE		32
762	SERVICING-GENERAL MAINTENANC		32
763	VEHICLE MAINTENANCE FACILITY		31
764	MOTOR VEHICLE SERVICE		31
765	MOTOR VEHICLE OPERATORS		34
766	TRACTOR TRAILER OPERATOR		34
772	MOTOR VEHICLE OPRERATOR - COLLECTIONS		34
773	TRACTOR TRAILER OPERATOR - COLLECTIONS		34
901	TRAVEL - VEHICLE SERVICE	30	31
933	MANAGER, MAINTENANCE OPERATIONS	35	
951	SUPERVISOR, MAINTENANCE OPERATIONS	35	
952	MANAGER/SUPERVISOR, MAINT OPERATIONS SUPPOR	35	
953	MANAGER, FIELD MAINTENANCE OPERATIONS	35	
	CUSTOMER SERVICES	FUNCTION 4	
240	MANUAL DISTRIBUITON STATION/BRANCH		43
353	STANDBY-CUSTOMER SERVICES	40	48
355	WINDOW SERVICE-STATION/BRANCH		45
539	ZIP+4 LOOKUP AT CMU/CFS		49
542	INSURED - COD - CUSTOMS		48
543	INSURED - COD - CUSTOMS		48
544	CAGES SERVING CARRIERS/SPECIAL DELIVERY MESSENGERS		48
558	OFFICE WORK & RECORDKEEPING-CUSTOMER SERVICES		48
559	OFFICE WORK & RECORDKEEPING-DELIVERY SERVICE		48
568	WINDOW SERVICE-MAIN OFFICE		45
583	EXPRESS MAIL-CUSTOMER SERVICE		48
608	STEWARDS - CLERKS - CUSTOMER SERVICES		48
621	TRAVEL - CUSTOMER SERVICES	40	48
631	MEETING TIME - CUSTOMER SERVICES	40	48
678	ADMIN & CLERICAL - AREA STATIONS		48
706	MANAGER/SUPERVISOR - CUSTOMER SERVICES	40	
741	MISC ACTIVITY-DELIVERY SERVICES		48
742	MISC ACTIVITY-CUSTOMER SERVICES		48
769	STATION/BRANCH BOX SECTION		44
794	MISC MARKUP ACTIVITIES - STATION/BRANCH		48
795	ADDRESS LABEL PREPERATION		49

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
796	MAIL MARKUP/FORWARDING		49
797	COMPUTER MAIL FORWARDING		49
801	FSM - OUTGOING PRIMARY		42
802	FSM - OUTGOING SECONDARY		42
803	FSM - MANAGED MAIL		42
804	FSM - INCOMING SCF		42
805	FSM - INCOMING PRIMARY		42
806	FSM - INCOMING SECONDARY		42
807	FSM - BOX SECTION		42
811	LSM - OUTGOING PRIMARY		42
812	LSM - OUTGOING SECONDARY		42
813	LSM - MANAGED MAIL		42
814	LSM - INCOMING SCF		42
815	LSM - INCOMING PRIMARY		42
816	LSM - INCOMING SECONDARY		42
817	LSM - BOX SECTION		42
818	LSM - BAR CODE READ - OUTGOING		42
819	LSM - BAR CODE READ - INCOMING		42
821	AUTOMATED LETTERS - OUTGOING PRIMARY		41
822	AUTOMATED LETTERS - OUTGOING SECONDARY		41
823	AUTOMATED LETTERS - MANAGED MAIL		41
824	AUTOMATED LETTERS - INCOMING SCF		41
825	AUTOMATED LETTERS - INCOMING PRIMARY		41
826	AUTOMATED LETTERS - INCOMING SECONDARY		41
827	AUTOMATED LETTERS - BOX SECTION		41
828	AUTOMATED LETTERS - SECTOR/SEGMENT, 1ST PASS		41
829	AUTOMATED LETTERS - SECTOR/SEGMENT, 2ND PASS		41
912	AUTOMATED LETTERS - DELIVERY POINT SEQUENCE, 1ST PASS		41
913	AUTOMATED LETTERS - DELIVERY POINT SEQUENCE, 2ND PASS		41
929	MANAGER, CUSTOMER SERVICES OPERATIONS	40	
980	SSPC TECH STA/BR - MAINTENANCE	40	46
981	SSPC TECH STA/BR - MAINTENANCE TRAVEL	40	46
982	SSPC TECH STA/BR - SERVICE	40	46
983	SSPC TECH STA/BR - SERVICE TRAVEL	40	46
984	SSPC TECH MAIN OFC-MAINTENANCE	40	46
985	SSPC TECH MAIN OFC-MAINTENANCE TRAVEL	40	46
986	SSPC TECH MAIN OFC-SERVICE	40	46
987	SSPC TECH MAIN OFC-SERVICE TRAVEL	40	46

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
	FINANCE	**FUNCTION 5**	
540	MISC ACTIVIVIES-- FINANCE	50	56
556	OFFICE WORK & RECORDKEEPING-FINANCE	50	56
569	C/RA - NON FINANCE EMPLOYEE	50	57
579	ODIS - NON FINANCE EMPLOYEE	50	57
591	ODIS - FINANCE EMPLOYEE	50	57
592	C/RA - FINANCE EMPLOYEE	50	57
599	MANAGER, FINANCE	50	
610	STEWARDS - CLERKS - FINANCE		56
623	TRAVEL - FINANCE	50	56
633	OTHER TIMEKEEPING		58
635	MEETING TIME - FINANCE - SUPERVISION	50	
636	MEETING TIME - FINANCE - NON SUPERVISION		56
649	PSDS OPERATIONS		53
650	BUDGET & FINANCIAL ANALYSIS		54
651	ADMIN & CLERICAL - FINANCE		56
683	ADMIN & CLERICAL - ACCOUNTING SERVICES		52
684	ADMIN & CLERICAL - BUDGET & FINANCIAL ANALYSIS		54
685	POSTAL SYSTEMS COORDINATOR		55
703	SUPERVISOR, FINANCE	50	
923	STATISTICAL PROGRAMS COORDINATOR	50	
936	SUPERVISOR , ACCOUNTING SERVICES	50	
937	GENERAL SUPERVISOR, PSDS OPERATIONS	50	
968	EXCHANGE OFFICE RECORD UNIT - INTERNATIONAL		52
969	STATISTICAL PROGRAMS-INTERNATIONAL		57
	HUMAN RESOURCES	**FUNCTION 6**	
541	MISC HUMAN RESOURCE ACTIVITIES	60	61
557	OFFICE WORK & RECORDKEEPING-HUMAN RESOURCES		62
566	TRAINING SUPPORT		65
572	PERSONNEL SECTION		62
600	MANAGER, HUMAN RESOURCES	60	
611	STEWARDS - CLERKS - HUMAN RESOURCES		61
641	MEETING TIME - HUMAN RESOURCES-SUPERVISION	60	
642	MEETING TIME - HUMAN RESOURCES - NON-SUPERVISION		61
643	INJURY COMPENSATION		66
652	LABOR RELATIONS		61
653	SAFETY & HEALTH		63
654	EEO		64
686	ADMIN & CLERICAL - LABOR RELATIONS		61
687	ADMIN & CLERICAL - EEO		64
689	ADMIN & CLERICAL - PERSONNEL SERVICES		62
691	ADMIN & CLERICAL - TRAINING SUPPORT		65
692	ADMIN & CLERICAL - SAFETY/HEALTH		63
902	TRAVEL - HUMAN RESOURCES	60	61
958	REHABILITATION		69
959	LIMITED DUTY		68

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
	CUSTOMER SERVICES SUPPORT	**FUNCTION 7**	
001	PLATFORM ACCEPTANCE & WEIGHERS UNIT		79
550	PRESORT VERIFICATION		79
551-552	CLAIMS & INQUIRIES		75
601	MANAGER, CUSTOMER SERVICES SUPPORT	70	
655	SUPERVISOR, BUSINESS MAIL ENTRY	70	
656	COMMERCIAL SALES & ACCOUNT MANAGEMENT		71
657	POSTAL BUSINESS CENTERS		72
658	EXPEDITED MAIL SERVICE		73
659	RETAIL MARKETING		74
660	MAILING REQUIREMENTS & BUSINESS MAIL ENTRY		79
661	CONSUMER AFFAIRS		76
662	ACCOUNTABLE PAPER		77
663	ADMIN & CLERICAL - CUSTOMER SERVICES SUPPORT		78
693	ADMIN & CLERICAL - POSTAL BUSINESS CENTERS		72
694	ADMIN & CLERICAL - EXPEDITED MAIL SERVICE		73
696	ADMIN & CLERICAL - RETAIL MARKETING		74
697	ADMIN & CLERICAL - MAILING REQUIRE. & BUS. MAIL ENTRY		79
903	TRAVEL - CUSTOMER SERVICES SUPPORT	70	78
946	MANAGER, POSTAL BUSINESS CENTERS	70	
948	MANAGER, COMMERCIAL ACCOUNTS	70	
949	MANAGER, CONSUMER AFFAIRS & CLAIMS	70	
950	MANAGER, BUSINESS MAIL ENTRY	70	
	ADMINISTRATION	**FUNCTION 8**	
455-462	AREA/DISTRICT PROJECTS - SUPERVISION	88	
463-470	AREA/DISTRICT PROJECTS - NON-SUPERVISION		89
471-504	HEADQUARTERS PROJECTS - SUPERVISION	88	
505-538	HEADQUARTERS PROJECTS - NON-SUPERVISION		89
570	ADMIN SERVICES - SUPPLY	81	82
571	EXECUTIVE SECTION	81	82
602	MANAGER, ADMINISTRATIVE SERVICES	81	
648	INFORMATION SYSTEMS		84
665	ADMIN & CLERICAL - ADMINISTRATION		82
666	PURCHASING		83
670	FACILITIES		85
671	POSTMASTER/INSTALLATION MANAGER	80	
682	ADMIN & CLERICAL - INFORMATION SYSTEMS		84
904	TRAVEL - ADMINISTRATION	81	82
934	MANAGER, INFORMATION SYSTEMS	81	
	TRAINING	**FUNCTION 9**	
780	TRAINING - OPERATIONS SUPPORT	90	90
781	TRAINING - MAIL PROCESSING	91	91
782	TRAINING - DELIVERY SERVICES	92	92
783	TRAINING - PLANT & EQUIPMENT MAINTENANCE	93	93
784	TRAINING - CUSTOMER SERVICES	94	94
785	TRAINING - FINANCE	95	95
786	TRAINING - HUMAN RESOURCES	96	96
787	TRAINING - CUSTOMER SERVICES SUPPORT	97	97
788	TRAINING - ADMINISTRATION	98	98
789	TRAINING - VEHICLE SERVICES	93	93

MODS OPERATION NUMBERS

MODS OPER	DESCRIPTION	LDC SUPV	LDC NON-SUPV
	SPECIAL OPERATIONS		
777	INCOMING LETTERS FLOWED TO ROUTE/BOX		
778	INCOMING FLATS FLOWED TO ROUTE/BOX		
888	FLOWED AS FINALIZED		
988	LOANED AS OFFICER-IN-CHARGE		
989	LOANED TO HEADQUARTERS		
990	LOANED AS SUPERVISOR		
991	LOANED AS CLERK		
992	LOANED AS MAIL HANDLER		
993	LOANED AS CARRIER		
994	LOANED AS SPECIAL DELIVERY MESSENGER		
995	LOANED AS VMF MECHANIC		
996	LOANED AS MAINT BUILDING SERVICES		
997	LOANED AS RURAL CARRIER		
998	TIME & ATTENDANCE CORRECTION		
999	INVALID OPERATIONS	50	53

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EXHIBIT USPS-14B
CALCULATING THE SYSTEM VOLUME VARIABILITY FOR MODS OFFICES

This exhibit presents the calculation of the "system" or average variability for MODS offices. This system variability is applied to non-MODS offices and certain general support operation in MODS offices.

The average variability is calculated in three steps:

Step 1: Multiply the volume variability for each cost pool times the accrued cost in that cost pool to form the associated volume variable cost pool.

Step 2: Sum the accrued costs across all pools and the volume variable costs across all pools.

Step 3: Divide the summed volume variable costs by the summed accrued costs to calculate the system volume variability.

These steps are carried out the next page.

CALCULATING THE SYSTEM VOLUME VARIABILITY FOR MODS OFFICES

COST POOL FROM WITNESS DEGEN TABLE 4	ACCRUED COST FROM WITNESS DEGEN TABLE 4 ($1,000s)	VARIABILITY	VOLUME VARIABLE COST
BCS, BCS ON OCR,	$ 681,360	94.50%	$ 643,885
OCR	$ 224,198	78.60%	$ 176,220
SPFSM, FSM & FSM/BCR	$ 736,959	91.80%	$ 676,530
LSM, MPLSM AND SPLSM W/BCR	$ 731,680	90.50%	$ 662,170
MECH. SORT - SACK OUTSIDE	$ 47,771	99.10%	$ 47,341
MECHANIZED PARCELS	$ 9,607	90.20%	$ 8,666
SPBS-NON PRIORITY	$ 174,127	46.90%	$ 81,666
SPBS- PRIORITY	$ 57 968	80 20%	$ 46,450
MANUAL FLATS	$ 514,846	86.60%	$ 445,856
MANUAL LETTERS	$ 1,342,326	79.70%	$ 1,069,834
MANUAL PARCELS	$ 60,049	39 50%	$ 23,719
MANUAL PRIORITY	$ 222,512	44.80%	$ 99,685
LDC 15 - RBCS	$ 382,392	100.30%	$ 383,539
AIR CONTRACT DCS AND INCOMING	$ 58,033	82 90%	$ 48,108
BULK PRESORT	$ 11,667	72.60%	$ 8,470
CANCELLATION AND MAIL PREPARATION - METERED	$ 287,698	65.40%	$ 188,154
MANUAL SORT - SACK OUTSIDE	$ 169,234	52.60%	$ 89,017
OPENING UNIT - PREFERRED MAIL	$ 745,408	72.00%	$ 536,694
OPENING UNIT BBM	$ 315,068	74 10%	$ 233,465
PLATFORM	$ 891,539	72.60%	$ 647,257
POUCHING OPERATIONS	$ 437,919	82.90%	$ 363,036
BUSINESS REPLY /POSTAGE DUE	$ 31,344	79.70%	$ 24 981
EXPRESS MAIL	$ 79,142	44.80%	$ 35,456
MAILGRAM	$ 368	79 70%	$ 293
REGISTRY MAIL DISTRIB.	$ 126,946	15.30%	$ 19,423
TOTAL	$ 8,340,173		[illegible]
AVERAGE VARIABILITY			[illegible]