USPS-T-21

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

POSTAL RATE AND FEE CHANGES, 1997

Docket No. R97-1

DIRECT TESTIMONY
OF
CHRISTOPHER S. BREHM
ON BEHALF OF
UNITED STATES POSTAL SERVICE

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LIST OF EXHIBITS

Direct Testimony
of
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AUTOBIOGRAPHICAL SKETCH

My name is Christopher S. Brehm. I am a Principal Consultant in the Management Consulting Services division of Price Waterhouse LLP (hereafter Price Waterhouse) in Arlington, Virginia. I have been employed by Price Waterhouse since 1993.

During my career with Price Waterhouse, I have worked on numerous consulting projects for the United States Postal Service. My area of specialization is in financial analysis, with an emphasis on cost analysis. My experience with the Postal Service includes attributable cost analysis in the areas of retail services, transportation, and new products, as well as transportation procurement.

From 1990 to 1991, I was employed by the Bureau of Labor Statistics, where I worked on the Occupational Safety and Health Survey.

My academic background includes an B.A. degree from James Madison University, where I graduated *Summa Cum Laude* in Economics, and a M.S. in Economics from the University of Maryland. I have also completed all of the course work for a Ph.D. in Economics at the University of Maryland, where I concentrated in Industrial Organization and Labor Economics. While at the University of Maryland, I taught courses in microeconomics and labor economics and won several teaching awards.

I. PURPOSE AND SCOPE

The purpose of my testimony is to update the variability estimates for window clerk costs that were presented by witness LaMorte in Docket No. R90-1 (USPS-T-6). The framework for estimating window service variability factors presented in Docket No. R90-1 is based on three separate components; demand-side variability, supply-side variability, and network variability. I use new data from a July, 1996 window service transaction time study to update the window service supply side variability factors. In addition, with this new dataset, I estimate variability factors for window activities that previously were not analyzed.

My testimony is organized into the following four sections. First, the framework that was used to estimate window service variability factors in Docket No. R90-1 is reviewed. Second, the transaction time study that is used to update the supply side variability factors is described. Third, the new transaction time study data are used to estimate new supply side variability factors. Finally, the new estimates are used to develop updated window service variability factors.

II. REVIEW OF FRAMEWORK FOR WINDOW SERVICE VARIABILITY FACTORS

Since Docket No. R76-1, window service costs have been separated into three groups to facilitate variability analysis; postage sales, activities involving classes of mail and special services, and other window service costs. A listing of the activities within each of these three groups and the costs that accrued to each activity in the base year are listed in Table 1.

Table 1: Window Service Activities and Accrued Costs

Window Activities	Accrued Costs[1]
Postage Sales	
Selling Stamps	$641,321,510
Selling Cards	$12,928,340
Setting Meters	$27,132,220
Activites Involving Classes of Mail and Special Services	
First-Class	$84,766,080
Priority Mail	$38,454,770
Express Mail	$17,454,000
Second-Class	$1,862,810
Third-Class	$10,359,110
Fourth-Class	$10,500,800
Other Mail	$22,786,900
Money Orders	$78,250,030
Post Office Boxes	$40,256,450
Other Special Services	$51,242,470
Other Window Service Activities	
Clerk Waiting Time	$257,251,800
Overhead	$124,042,040
Uniform Allowance and Lump Sum	$12,674,397
All Other Costs	$475,336,020
Total Cost	$1,906,619,747

Table Notes

[1] Accrued costs are taken from the window service cost pools developed in USPS-T-5, WP B3, W/S 3.2.1, pp.1-2. These costs do not include variability factors.

A. Postage Sales

The postage sales category includes four subactivities; stamp sales, meter settings, stamped card sales, and stamped envelope sales. Each of these subactivities has a separate variability factor. This factor is measured through three separate indirect effects, which, when combined, describe the relationship between volume changes and window

service cost changes. These three indirect effects are the demand side variability, the supply side variability and the network variability, and are described in more detail below.[1]

1. Demand Side Variability

The first indirect effect of a change in postage volume is the demand side effect, which measures the degree to which a change in mail volume changes the number and type of transactions. This variability, which is expressed as a percentage change in transactions caused by a percentage change in mail volume, is less than or equal to one because customers may not necessarily increase their visits to the post office in response to an increase in mail volume. Instead, they may increase the number of services purchased during each trip to the post office.

In Docket No. R90-1, the estimate for the demand side effect was based on two different models of customer behavior. The first model, the fixed size transaction model, held that consumers purchase a fixed amount of postage in each transaction. Therefore, an increase in mail volume caused an increase in transactions, or visits to the post office. The second model, the fixed interval model, assumed that consumers purchase postage at regular intervals. Therefore, an increase in mail volume was absorbed in the consumers' regular visits to the post office, and no new transactions occurred.

For customers that followed the fixed purchase model, an increase in volume led to a proportionate increase in transactions. Therefore, their demand side variability was equal to one. Customers that followed the fixed interval model, on the other hand, simply increased the size of their postage purchase during their regular visit to the post office in response to a mail volume increase. Therefore, this group had a demand side variability equal to zero.[2]

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[1] See also Docket No. R90-1, USPS-T-6, pp. 15-16.

[2] Docket No. R90-1, USPS-T-6, p. 16.

A customer survey was conducted in November, 1983 to determine the proportion of customers that followed the fixed purchase and fixed interval behavior models. The survey was based on a sample of 120 post offices and 25,689 customers. Customers were asked to fill out a questionnaire that asked how their purchasing behavior would change in response to a change in mail volume. The resulting development of the demand side variability estimates for the four categories of postage is provided in the following table.

Table 2: Development of Demand Side Variabilities[3]

	Fixed Purchase Customers				*Fixed Interval Customers*				
Postage Sales Categories	Percentage		Demand Side Variability		Percentage		Demand Side Variability		Demand Side Variability
Selling Stamps	[(.6588	*	1.00)	+	(.3412	*	0)]	=	65.88%
Selling Cards	[(.5044	*	1.00)	+	(.4956	*	0)]	=	50.44%
Selling Meters	[(.2605	*	1.00)	+	(.7395	*	0)]	=	26.05%
Selling Plain Stamped Envelopes	[(.4793	*	1.00)	+	(.5207	*	0)]	=	47.93%

These estimates formed the basis for the variability estimates in Docket No. R90-1, and are again used to represent the demand side variabilities in the current Docket.

2. Supply Side Variability

The second indirect effect of a volume increase is the supply side effect, which measures the effect that an increase in transactions, or a changed transaction profile, has on clerk processing time. As with demand side effects, the supply side variability is different for each of the four categories of postage. The methodology followed by witness LaMorte in Docket No. R90-1 to develop supply side variabilities will be discussed, and the areas that are refined in the current Docket are highlighted.

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[3] Docket No. R90-1, USPS-T-6, pp. 16-19.

In Docket No. R90-1, the supply side variability was estimated by separately examining fixed interval and fixed purchase consumers. Fixed interval customers respond to mail volume increases by increasing the size of their postage purchase during their regular trips to the post office. The supply side variability associated with an increase in the size of a postage sale was found to be zero, due to the significant economies of scale in postage sales. That is, the same amount of time was required to process a transaction in which one book of stamps was purchased as when two books of stamps were purchased.[4] Analysis of the most recent transaction time study confirms this finding.

Fixed purchase customers, however, increase their visits to the post office, which will increase clerk processing time. In Docket No. R90-1, it was estimated that these new purchases would result in a supply side variability of 100 percent, because the increase in clerk processing time is proportionate to the increase in the number of transactions.[5] I examine this finding in more detail in section IV using the results of the recent transaction time study, and find the variability to be less than 100 percent.

The combined demand and supply side variability factors for the four postage categories from Docket No. R90-1 were calculated in the following manner. For stamp sales, 65.88 percent of all consumers follow the fixed purchase model. For these customers, an increase in volume generated a proportionate increase in new transactions. The supply side variability, therefore, was estimated to be 100 percent. The remaining 34.12 percent of all consumers followed the fixed interval model, and responded to volume increases by making larger purchases. The significant economies of scale in stamp purchases enabled window clerks to process the larger stamp purchases without incurring

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[4] Docket No. R90-1, USPS-T-6, p. 21.

[5] Docket No. R90-1, USPS-T-6, p. 20.

additional processing time. Therefore, the supply side variability was zero for this group. The combined demand and supply side variability for stamp purchases was then calculated as a weighted average.[6]

3. Network Variability

The third indirect effect captures the degree to which clerk staffing costs increase as clerk processing time increases. This effect is called the network variability and measures the percentage change in total window costs resulting from a percentage change in processing time. This variability can take a value of either less than, equal to, or greater than 100 percent. A variability of less than 100 percent implies that post offices absorb increases in processing time with relatively small increases in staffing time. A variability of more than 100 percent means that an increase in processing time causes a disproportionately large increase in staffing.

In Docket No. R90-1, witness LaMorte compared the time that clerks spend processing transactions to total clerk staffing time. This information was gathered as part of a transaction profile study that collected information on processing and staffing time. Econometric analysis of this data found a linear relationship, which emanated from the origin, between processing time and staffing time. This, in turn, led witness LaMorte to conclude that increases in staffing time cause proportionate increases in staffing time. Therefore, the network variability is 100 percent.[7] Like the demand side effects discussed earlier, this result is not updated in the current Docket.

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[6] Docket No. R90-1, USPS-T-6, pp. 21-22.

[7] Docket No. R90-1, USPS-T-6, pp. 28-33.

4. The Combined Effect

The method of combining the three indirect variabilities into a single relationship between mail volume changes and window costs is shown in the following equation:[8]

$$\frac{\delta S}{\delta V}\frac{V}{S} = \frac{\delta T}{\delta V}\frac{V}{T} * \frac{\delta C}{\delta T}\frac{T}{C} * \frac{\delta S}{\delta C}\frac{C}{S}$$

where, S = Window Clerk Staffing Costs

V = Mail Volume

T = Window Transaction Volume

C = Transaction Processing Time

This equation states that window service variability is calculated as the product of three separate, indirect effects; the demand side variability $\frac{\delta T}{\delta V}\frac{V}{T}$, the supply side variability $\frac{\delta C}{\delta T}\frac{T}{C}$, and the network variability $\frac{\delta S}{\delta C}\frac{C}{S}$.

B. Activities Involving Classes of Mail and Special Services

Variability estimates for activities involving classes of mail and special services were developed in a different manner than variability estimates for postage sales in Docket No. R90-1. Witness LaMorte argued that demand side effects, which are measured through customer surveys, would be difficult to capture for classes of mail and special services. She asserted that customers would have difficulty responding in a meaningful way to a questionnaire regarding their purchasing behavior for non-postage services. Therefore, variability estimates for activities involving classes of mail and special services are determined on the basis of how the In-Office Cost System (IOCS) assigns window costs.[9]

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[8] Docket No. R90-1, USPS-T-6, p. 8.

[9] Docket No. R90-1, USPS-T-6, p. 23.

Before discussing the specifics of how IOCS allocates costs to activities, it is useful to outline the structure of a window service transaction. There are two essential components of all window transactions. The first is the service component, which includes the time required to process the services requested by the customer. For a weigh and rate activity, the service time includes the time required to place the item on the scale, determine the weight and price, communicate the price, or prices, to the customer, decide on a class of mail, and print and apply the postage strip. The second component is the "common time" that is associated with all transactions, regardless of the services provided. This common time includes the time it takes the clerk to wait for the customer to arrive at the window, exchange greetings, accept payment, make change, and end the transaction.[10] The essential feature of a retail transaction is that once the common time is incurred to process a one element transaction, additional services can be processed in the same transaction without having to re-incur the common time. It is this feature that leads to economies of scale in retail transactions.

IOCS assigns window costs based on the activity that is observed at a particular point in time. For example, if the data collector observes the window clerk performing the service component of a weigh and rate transaction, the IOCS observation would cause costs to accrue to the weigh and rate (activities related to specific classes of mail) cost pool.[11] In addition, IOCS also attributes the common time to the product or products that are sold in the transaction. If the weigh and rate transaction is a one element transaction, the IOCS

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[10] It is called "common time" because it is common to all transactions.

[11] If the data collector observes the service portion of the weigh and rate transaction, the data collector would record the IOCS reading as a weigh and rate, regardless of whether the transaction is a single element or multiple element transaction.

observation will be recorded as a weigh and rate activity, regardless of when the reading takes place in the transaction.

Witness LaMorte explained that the variability associated with an increase in single element transactions would be 100 percent. That is, an increase in one new weigh and rate results in a proportional increase in clerk processing time – clerk processing time increases by both the common time and the service time as a result of the new weigh and rate request.

Assigning the common time for a multiple element transaction to a window activity is not as straightforward as for a single element transaction. Therefore, for multiple element transactions, IOCS data collectors are instructed in the following manner when sampling the common time of a transaction:

> If, at the time of the (IOCS) reading, the customer being served is either saying hello or good-bye, or is paying for several items, then choose the item (or service) provided by the clerk immediately after the greeting or the last service provided before the payment and good-bye.[12]

These data collection rules imply that some portion of the common time is included in the cost pools of each of the elements in a multiple element transaction. Using the results of a 1988 transaction time study, witness LaMorte found that a weigh and rate service that occurs as part of a multiple element transaction is over 60 percent variable, but the exact figure was not known. Because the exact variability for multiple element transactions was not known, combining the variabilities from the single and multiple element transactions was not possible. Therefore, witness LaMorte concluded that the total variability for the weigh and rate activity was 100 percent.[13] The variability factors for the other activities related to classes of mail or special services were calculated in a similar manner.

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[12] Docket No. MC96-3, USPS LR-SSR-12, p. 75 (Handbook F-45).

[13] See Docket No. R90-1, USPS-T-6, p. 26.

C. Other Window Service Activities

Window service activities other than postage sales and activities involving classes of mail and special services were considered to be institutional and assigned a zero percent variability factor in Docket R90-1. The exception was clerk waiting time. The results of the network variability analysis, described above, showed that total processing time increases proportionately with total staffing time. This implied that waiting time also increases proportionately with processing time, and, therefore, was considered to be 100 percent variable.[14]

III. WINDOW SERVICE TRANSACTION TIME STUDY

The data used to estimate updated variability factors was collected in a recent study of retail transactions. The transaction time study (TTS) was a two-week data collection effort that measured the duration of window service transactions, the services provided during the transactions, the method of payment, and the total transaction value. TTS data were collected at 20 randomly selected post offices in July, 1996.

For the purposes of the transaction time study, the beginning of a transaction was defined to be the point at which the clerk greeted the customer and indicated that they were ready to help the customer. The transaction ended when all components of the transaction were completed and the clerk was available to help another customer. Data collectors observed the retail transactions by standing behind the counter, where they could observe the transaction as well as the retail terminal. Approximately every thirty minutes they moved to the next open window. Information was collected on 7,806 transactions. After data editing and review, 7,175 transactions remained. More detailed documentation of the TTS is presented in USPS LR-H-167.

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[14] Docket No. R90-1, USPS-T-6, p. 33.

IV. DEVELOPMENT OF NEW VARIABILITY FACTORS

The new transaction time study provides a data source to examine and update two sections of the window service variability analysis from Docket No. R90-1. The first is the degree to which economies of scale exist in postage sales. I confirm witness LaMorte's finding that complete economies of scale exist in postage sales. The second section is an update of the supply side variability factors for postage sales and activities involving classes of mail and special services. In addition, variability factors are estimated for Express Mail transactions, which were not examined in previous studies.

A. Econometric Analysis of the Economies of Scale in Postage Sales

An important finding in Docket No. R90-1 was the strong economies of scale in postage sales.[15] This finding enabled witness LaMorte to conclude that consumers that increase the size of their postage purchases, without increasing their number of visits to the post office, will not cause an increase in window clerk processing time. In the current Docket, I reexamine and confirm this result with the new TTS data.

The existence of economies of scale for postage sales was investigated using regression analysis on data from single component transactions. Because of limited data, only stamp sales and meter settings are analyzed. After isolating the single component transactions, the two equations that are used to estimate the relationship between transaction time and the size of the transaction for stamps and meters are listed below.[16]

Stamps: $transaction\ time_i = \beta_0 + \beta_1 * STValue_i + \gamma_1 * credit\ card_i + \gamma_2 * check_i + \varepsilon_i$

Meters: $transaction\ time_i = \beta_0 + \beta_1 * MEValue_i + \gamma_1 * check_i + \varepsilon_i$

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[15] Selling one book of stamps, for example, takes approximately the same amount of time as selling two books of stamps.

[16] A variable for credit card purchases is not included in the regression for economies of scale in meter transactions because credit cards are not an accepted method of payment for meter settings.

where, *transaction time*$_i$ = the duration of transaction *i*, in seconds

STValue$_i$ = is the value of the stamp sale in transaction *i*, in dollars,

MEValue$_i$ = is the value of the meter setting in transaction *i*, in dollars,

credit card$_i$ = 1 if the customer paid with a credit card in transaction *i*, and

check$_i$ = 1 if the customer paid with a check in transaction *i*.

The results from these two equations are listed in Exhibit USPS-21A.[17] For stamp sales, the regression results show that increasing the value of the stamp sale by one dollar increases the transaction time by 0.111 seconds. Because of the very small increase in time that results from increasing the size of a stamp purchase, the economies of scale in stamp purchases are very strong.

For meter sales, the regression results show that transaction time increases by 0.012 seconds for each dollar that is added to a meter. However, the t-statistic, which is only 0.959, shows that this estimate is not statistically different from zero. Even if it were a statistically reliable estimate, increasing the size of a meter setting by $100 would increase the total transaction time by only 1.2 seconds. Therefore, the economies of scale in meter settings appear to be strong.

B. Econometric Analysis of Postage Sales and Activities Involving Classes of Mail and Special Services

In Docket No. R90-1, transaction time study data from 1988 were used to make inferences about the variabilities for a number of different window service activities. With the recent TTS data, we update two components from Docket No. R90-1.

The first component that is updated is the supply side variability for postage sales. In Docket No. R90-1, the supply side variability for postage sales for consumers that follow the

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[17] See USPS LR-H-167 for a explanation of the methodology and a complete listing of the results.

fixed purchase model was estimated to be 100 percent. Consumers that follow the fixed purchase model respond to a volume increase by visiting the post office more often, and, therefore the Postal Service incurs both the common time and service time as a result of the new postage purchase. Because this implies a proportional increase in both the transaction and the processing time, the variability was 100 percent. This argument, however, assumes that all new postage sales arrive at the post office as single item transactions. To the extent that customers add the new postage purchase to an existing transaction, such as a weigh and rate, the supply side variability of new postage sales may be less than 100 percent. By looking at individual transactions in the TTS data, we can estimate the actual percentage increase in time caused by an additional postage transaction.

The second component that is updated is the variability of activities involving classes of mail and special services. In Docket No. R90-1, transaction time information was used to place the variability of weigh and rate transactions somewhere between 60 percent and 100 percent. However, because the exact figure was not known, it was assumed to be 100 percent. With the most recent TTS, we estimate the percentage change in time caused by additional window activities. These results are used to estimate variability factors for five window service activities; selling stamps, setting meters, weighing and rating mail, processing Express Mail, and selling Money Orders.

The new variability factors are estimated in two steps. First, the marginal increase in processing time caused by window activities such as selling stamps, setting meters, and weighing and rating mail is calculated. Second, the marginal increases in time are converted into a variability factor. This remainder of this section describes the steps that were taken to

estimate the marginal increase in clerk processing time that results from providing additional services, such as selling stamps or weighing and rating parcels.[18]

1. Equation Specification

The equation that is used to estimate the marginal increase in time is specified as a linear equation, where transaction time is a function of the activities that occur in a transaction. The form of the equation is listed below:

$$transaction\ time_i = \beta_0 + \beta_1 * ST_i + \beta_2 * WR_i + \beta_3 * MO_i + \beta_4 * EX_i + \sum_{j=1}^{n} \beta_j * element_{ji} +$$

$$+ \gamma_1 * credit\ card_i + \gamma_2 * check_i + \varepsilon_i$$

where, $transaction\ time_i$ = the duration of transaction i,

ST_i = is equal to 1 if transaction i involved a stamp sale,

WR_i = is the number of parcels that are weighed and rated in transaction i,

MO_i = is the number of money orders that that are processed in transaction i,

EX_i = is the number of Express Mail pieces that are processed in transaction i

$element_{ji}$ = the remaining n elements that are included in the regression,

$credit\ card_i$ = 1 if the customer paid with a credit card in transaction i, and

$check_i$ = 1 if the customer paid with a check in transaction i .

A complete listing of the services that are included in the initial regression is provided in Exhibit USPS-21B.

A logarithmic specification was considered for this analysis, but was rejected because of practical considerations regarding the nature of the dataset. For a more detailed discussion of this topic, see USPS LR-H-167.

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[18] See USPS LR-H-167 for the complete documentation of the econometric analysis.

2. Initial Regression

The initial regression used the linear specification described above and included all activities that were captured in the transaction time study. The method of estimation was Ordinary Least Squares (OLS). The results are displayed in the Model 1 column of Exhibit USPS-21B. The parameter estimates are expressed in seconds, and can be interpreted in the following manner. Adding a stamp sale to a transaction, for example, increases the clerk processing time by an additional 11.2 seconds. Also, weighing and rating one additional parcel increases the total transaction time by 14.7 seconds. The common time associated with a retail transaction is captured in the intercept term, which is 38.0 seconds.

3. Refined Regression

The initial regression results show that a number of services and activities have statistically insignificant marginal time estimates. These variables tend to be the less frequently observed services, which makes estimating statistically significant coefficients difficult. Therefore, in the next step, these variables are dropped from the analysis, and a new regression is run. The results of this regression, again estimated using OLS, are displayed in the Model 2 column of Exhibit USPS-21B.

4. Heteroscedasticity Tests and Correction

One of the important assumptions of OLS is that the error terms, ε_i, have uniform variance. When the error terms have unequal variances the results are said to be heteroscedastic. Even with heteroscedasticity, the OLS coefficients will be unbiased and consistent. However, the standard errors used to determine the reliability of the results will be affected. To be more specific, the estimated coefficients are not affected by heteroscedasticity, but the standard errors of the estimates will be understated. As a result,

the t-statistics may be overstated, which may cause the reliability of the estimates to be overstated.

I tested for, and found, heteroscedasticity in the TTS regression using a White test,[19] then corrected the problem using a technique know as the White correction.[20] I generate the White-corrected standard errors and t-statistics and present the results in the Model 3 column of Exhibit USPS-21B. The results show that the heteroscedasticity-corrected standard errors are larger than the original standard errors from Model 2. The resulting t-statistics are lower, but the tests for statistical significance are not overturned for the key variables in the analysis.[21] A more complete discussion of the heteroscedasticity test and correction are presented in USPS LR-H-167.

5. Limiting the Effects of Influential Observations

It is reasonable to expect the transaction time study data to contain some degree of variance that cannot be accounted for in the regression equations. This could include cases where the customer requested a specific type stamp that the window clerk had difficulty finding, or other transactions where the customer consumed an extraordinary amount of the window clerk's time. Because of these possibilities, I conducted a test to find and limit the effects of "influential" observations. The method that was used was the DFFIT procedure.[22]

The DFFIT procedure examines the change in the i^{th} predicted value of the dependent variable, *transaction time*$_i$, when the i^{th} observation is omitted from the dataset and the OLS

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[19] White, Halbert, "A Heteroscedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity," *Econometrica*, 48, 1980, pp.817-838. Also see pp. 419-420 of Greene, William H., *Econometric Analysis*, New York, NY: MacMillan, 1990 for an explanation of this test.

[20] White (1980). Also see pp. 403-405 of Greene (1990) for an explanation of this technique.

[21] The key variables are stamp sales, meter settings, weigh and rates, Express Mail, Money Orders, and credit card and check payment variables.

[22] See Belsey, D., E. Kuh, and R. Welsch, *Regression Diagnostics, Identifying Influential Data and Sources of Collinearity*, New York: Wiley, 1980.

estimates are recalculated. This statistic is generated for each observation in the dataset. Large values of this statistic indicate that the observation may be overly "influential". The details of this procedure are provided in USPS LR-H-167. The results of the regression equation after eliminating these influential observations from the dataset are found in Model 4 of Exhibit USPS-21B. They show that this procedure increases the explanatory power of the regression – the R^2 increases from 0.37 to 0.42. In general, this procedure caused less time to be attributed to the common component of the transaction, and more time to be attributed to the services that are provided. It is these results that are used to generate the final variability estimates.

C. Interpreting the Intercept in the Regression Equations

In order to calculate the supply side variability factor, an accurate understanding of the intercept term is needed. The intercept in these regressions is measuring the common time associated with a transaction. It is the time that is common to all transactions, regardless of what services or activities are performed in the transaction. What distinguishes this time from a "fixed time" interpretation is that a service must be processed for the common time to be incurred.

D. Conversion of the Marginal Increases in Time Into Variability Estimates

The regression results presented in Model 4 of Exhibit USPS-21B provide the marginal increase in transaction time, expressed in seconds, as a result of processing an additional service. In order to get a variability, this marginal change needs to be converted into a percentage change. The methodology for calculating the marginal increase in transaction time and converting it into a variability factor is described in the following three sections.

1. Calculation of Marginal Increase in Transaction Time

It is important to realize that each coefficient estimated in Model 4 of Exhibit USPS-21B measures the increase in transaction time from processing a service, when the service is added to an existing transaction. That is, the coefficients do not account for an increase in services that arrive at the window through new transactions. To get an accurate estimate of the increase in clerk processing time when a new transaction arrives at the retail window, it is necessary to add the marginal service time, represented by the coefficient, and the common time, which is represented by the intercept.[23] Because an additional service could arrive as part of an existing transaction or it could generate a new transaction, we estimate a weighted average increase in transaction time. This weighted average represents a blend of the additional transaction time for the service that is processed as part of an existing transaction, and the transaction time when those services generate new transactions.

As an example of how the marginal increase in time is calculated, consider an increase in transaction time caused by an additional stamp sale. The average increase in transaction time caused by the sale is a blend of two different transaction times. The first is the marginal increase in time when the customer adds the new, additional stamp sale to an existing transaction. From the regression results in Model 4 of Exhibit USPS-21B, the increase in time is 13.3 seconds. The second time is the increase in time when the customer makes a new trip to the post office just to purchase stamps. Here, the additional processing time generated as a result of the stamp purchase is 47.5 seconds, for a cash purchase.[24]

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[23] See section IV.C for an interpretation of the intercept term.

[24] The transaction time for a single element stamp sale is equal to the common time plus the service time (34.2 seconds + 13.3 seconds = 47.5 seconds).

An additional adjustment needs to be made, however, to the average increase in time for a single element transaction. The analysis of the TTS data showed that accepting a credit card or check payment adds additional time to a window transaction. To accurately characterize the average increase in time caused by a new element that generates a new transaction, the time required to process these payment methods must be added. For stamp sales, the average time for a single element stamp sale is increased by (a) the proportion of single element stamp sales that involve credit card sales multiplied by the incremental time to process the credit card payment, and (b) the proportion of single element stamp sales that are check sales multiplied by the incremental time to process the check. The calculations of the average transaction time for single item transactions – accounting for the method of payment – are in Table 3.

Table 3: Calculation of Average Increase in Single Item Transaction Time with Credit Card and Check Payment

Window Service Activities	Common Transaction Time[1]		Incremental Service Time[1]		Incremental Credit Card Time[1]		Percent of Transactions with Credit Card Pmt.[2]		Incremental Check Time[1]		Percent of Transactions with Check Payments[2]		Average Single Item Transaction Time
Selling Stamps	34.224	+	13.313	+	102.862	*	0.86%	+	34.395	*	14.30%	=	53.343
Setting Meters	34.224	+	217.313	+	102.862	*	0.00%	+	34.395	*	52.38%	=	269.554
Weigh and Rate	34.224	+	21.534	+	102.862	*	0.66%	+	34.395	*	5.31%	=	58.268
Express Mail	34.224	+	78.011	+	102.862	*	5.70%	+	34.395	*	12.66%	=	122.449
Money Orders	34.224	+	32.986	+	102.862	*	0.00%	+	34.395	*	0.00%	=	67.210

Table Notes
[1] See Exhibit USPS-21B for regression results
[2] USPS LR-H-167

To calculate a weighted average of the single element and multiple element scenarios, I use the proportion of stamp sales that are single element transactions and those that are multiple element stamp sales as the weighting factors.[25] This weighted average

[25] This calculation assumes that the profile of the marginal transaction is like the profile of the average transaction.

represents the marginal increase in time, on average, of an additional stamp sale. This time estimate is calculated in Table 4 for stamp sales, as well as four other window activities.

Table 4: Calculation of Average Increase in Transaction Time

Window Service Activities	*Single Element Transactions* Percent of Total Transactions[1]		Average Transaction Time[2]		*Multiple Element Transactions* Percent of Total Transactions[3]		Average Transaction Time[2]		Weighted Average Increase in Transaction Time
Selling Stamps	60.04%	*	53.343	+	39.96%	*	13.313	=	37.347
Setting Meters	62.69%	*	269.554	+	37.31%	*	217.313	=	250.061
Weigh and Rate	30.79%	*	58.268	+	69.21%	*	21.534	=	32.845
Express Mail	53.56%	*	122.449	+	46.44%	*	78.011	=	101.812
Money Orders	31.98%	*	67.2098	+	68.02%	*	32.9855	=	43.932

Table Notes
[1] Exhibit USPS-21B
[2] See Table 5
[3] USPS LR-H-167

2. The Formula for Converting Marginal Increases in Time to Variability Factors

The supply side variability factor is an elasticity that measures the percentage change in clerk processing time with respect to a percentage change in transactions.[26] The increase in clerk processing time that was calculated in the previous section was not expressed in percentage terms, however, but in seconds. Therefore, to convert a marginal change in transaction time into an elasticity that represents the supply side variability, we use the following formula:

$$Variability_i = \frac{\left(\frac{\delta\, transaction\ time}{\delta\, transaction\ element_i}\right)}{predicted\ time\ for\ a\ single\ element\ transaction\ i}$$

$Variability_i$ is the variability factor for activity i, and $element_i$ is the independent variable from the regression equation that causes costs to accrue to window service cost

[26] See Section II.A.2.

pool *i*.[27] [28] For example, the formula for the supply side variability of stamp sales is written as:

$$Variability_{ST} = \frac{\left(\frac{\delta\, transaction\ time}{\delta\, transaction\ element_{ST}}\right)}{predicted\ time\ for\ a\ single\ element\ ST\ transaction}$$

The first term on the right hand side is the increase in processing time caused by an additional stamp sale, which is explained above in section IV.B.3.b. The predicted time for a single element stamp transaction is calculated as:

$$Predicted\ Time_{ST} = \hat{\beta}_0 + \hat{\beta}_1 * ST + \hat{\delta}_2 * Credit + \hat{\delta}_2 * Check$$

$$Predicted\ Time_{ST} = 34.224 + 13.313 * (1) + 102.862 * (0.009) + 34.394 * (0.143)$$

$$Predicted\ Time_{ST} = 53.343$$

In the equation for predicted time, *ST* is equal to one for a single element stamp transaction, and *Credit* and *Check* are equal to the proportion of single element stamp transactions that have credit card or check payments, respectively.[29]

3. Updated Supply Side Variability Factors

In this final step of calculating supply side variability factors, I take the marginal and average transaction times from Tables 3 and 4, and implement the formula for calculating the variability from section b above. This calculation is performed in Table 5.

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[27] Examples of window service cost pools are selling stamps, setting meters, or activities related to classes of mail.

[28] An elasticity can be defined as a marginal change divided by the average change. This formula is the marginal increase in transaction time for element *i* divided by the average, or predicted, transaction time for element *i*.

[29] The predicted time is equivalent to the average time for a single element transaction, which is calculated in Table 5.

Table 5: Updated Supply Side Variability Factors

Window Service Activities	Weighted Average Increase in Transaction Time[1]		Predicted (Avg) Transaction Time[2]		Variability Factor
Selling Stamps	37.347	/	53.343	=	70.01%
Setting Meters	250.061	/	269.554	=	92.77%
Weigh and Rate	32.845	/	58.268	=	56.37%
Express Mail	101.812	/	122.449	=	83.15%
Money Orders	43.932	/	67.210	=	65.37%

Table Notes
[1] See Table 6
[2] See Table 5

V. WINDOW SERVICE VARIABILITY FACTORS

The final step in calculating the overall variability factors for window service activities is to insert the updated supply side variability into the three-part chain that was outlined in section II.A.4. It is important to note that postage sales categories – stamp sales and meter settings – require a demand side variability to trace the window cost change back to the mail volume change.[30] This is needed because at the time a transaction occurs, it is not possible to observe the number of pieces that will be generated from a postage sale. The method of estimating supply side variability factors in the current Docket for weigh and rate activities, Express Mail, and Money Orders, however, implicitly accounts for the demand side effects. This is because the TTS data collectors were able to observe the actual volume that was generated in each transaction that involved a specific class of mail or a special service. Therefore, the regression analysis draws a direct link between volume changes and changes in clerk processing time for these activities. A separate demand side variability factor is not needed.

[30] Weigh and rates, Express Mail, and Money Orders do not have demand side variability estimates. In Docket No. R90-1, witness LaMorte concluded that it would be difficult to ask consumers about their purchasing behavior related to classes of mail and special services.

The revised window service variability factors for Docket No. R97-1 are calculated in Table 6.[31] The variability factors from Docket No. R90-1 are also displayed.

Table 6: Docket No. R97-1 Proposed Window Service Variability Factors

Window Service Activities	Demand Side Variability[1]		Supply Side Variability[2]		Network Variability[3]		Docket No. R97-1 Variability Factor	Docket No. R90-1 Variability Factor[4]
Selling Stamps	65.88%	*	70.01%	*	100.00%	=	46.12%	65.88%
Setting Meters	26.05%	*	92.77%	*	100.00%	=	24.17%	26.05%
Weigh and Rate	-		56.37%	*	100.00%	=	56.37%	100.00%
Express Mail	-		83.15%	*	100.00%	=	83.15%	100.00%
Money Orders	-		65.37%	*	100.00%	=	65.37%	100.00%

Table Notes
[1] See Table 2
[2] See Table 7
[3] See pp. 5-6.
[4] Docket No. R90-1, Exhibit USPS-6B

[31] A variability of 78.53 percent was originally calculated for Express Mail, and is included in the Base Year calculation. Using a variability factor of 83.15% raises the volume variable costs for Express Mail by approximately $902,000. In addition, a variability of 24.07 percent was calculated for metered mail. Using a variability of 24.17 percent raises the volume variable costs by approximately $42,000, which would be distributed to metered mail.

Economies of Scale in Postage Sales

Dependent variable: length of transaction in seconds

		Model 1		Model 2	
Component	SAS Name	Parameter Estimate	t-stat	Parameter Estimate	t-stat
Intercept	INTERCPT	40.187	43.043	217.671	5.887
Stamp Value	STVAL	0.111	15.727		
Meter Value	MEVAL			0.012	0.959
Payment by Check	CHECK	34.273	13.772	57.476	1.276
Payment by Credit Card	CREDIT	78.332	8.420		
Adjusted R-Squared		0.2826		0.0077	

Transaction Time Study Regression Results

Dependent variable: length of transaction in seconds

Component	SAS Name	Model 1 Parameter Estimate	Model 1 t-stat	Model 2 Parameter Estimate	Model 2 t-stat
Intercept	INTERCPT	37.958	24.558	38.735	26.121
Purchase of Stamps	ST	11.153	5.775	10.572	5.544
Weigh/Rate Quantity	WRQUAN	14.655	22.306	14.548	22.233
Acceptance	AC	6.928	2.509	6.726	2.447
Express Quantity	EXQUAN	84.752	20.491	84.280	20.435
Money Order Quantity	MOQUAN	33.611	21.598	33.420	21.532
COD Accepted Quantity	CAQUAN	81.773	3.815	81.717	3.812
Meter Set Quantity	MEQUAN	204.813	28.179	204.396	28.142
Postage Due	PD	60.015	4.533	60.101	4.540
Caller Service	CS	1.218	0.054		
Retail Mailing Supplies	MS	43.940	9.739	43.477	9.653
Change of Address/Forward	CF	30.679	3.798	30.120	3.732
Mailing Payments	MP	80.489	5.248	79.954	5.214
Phone Card Quantity	PCQUAN	77.085	1.086		
Box Rental Quantity	BRQUAN	127.024	15.098	126.527	15.047
Pre-Stamped	EC	10.852	1.453	10.388	1.392
Inquiry Quantity	IQQUAN	42.086	16.383	41.568	16.275
Other	OT	93.823	17.384	93.311	17.313
Passport Quantity	PPQUAN	151.852	12.766	151.233	12.720
Return Receipt Quantity	RRQUAN	10.387	2.965	10.333	2.951
Registered Quantity	RGQUAN	94.760	16.941	94.949	16.983
Special Services Int'l Registered	SIRQUAN	66.458	2.957	66.028	2.938
Restricted Quantity	RDQUAN	142.044	2.001	141.452	1.993
Certified Quantity	CEQUAN	20.343	7.372	20.265	7.347
Insurance Quantity	INSQUAN	71.248	14.689	71.078	14.660
Special Services Cert Mailing	SCMQUAN	20.223	0.493		
GH General	GVP	64.053	13.532	63.477	13.443
GH Parcel Quantity	GPDQUAN	2.998	1.868		
Wrong Address	WA	-0.587	-0.064		
Returned Mail	RM	8.702	0.752		
Payment by Check	CHECK	52.957	15.934	53.073	16.000
Payment by Credit Card	CREDIT	112.257	13.213	112.334	13.225
Adjusted R-Squared		0.336		0.366	

Transaction Time Study Regression Results

Dependent variable: length of transaction in seconds

		Model 3			Model 4		
Component	SAS Name	Parameter Estimate	White-Corrected Variance	White-Corrected t-stat	Parameter Estimate	White-Corrected Variance	White-Corrected t-stat
Intercept	INTERCPT	38.735	7.221	14.414	34.224	1.298	30.037
Purchase of Stamps	ST	10.572	5.880	4.360	13.313	1.575	10.607
Weigh/Rate Quantity	WRQUAN	14.548	12.736	4.076	21.534	1.180	19 823
Acceptance	AC	6.726	6.927	2.556	1.341	2.770	0.806
Express Quantity	EXQUAN	84.280	29.046	15.638	78.011	8.236	27.183
Money Order Quantity	MOQUAN	33.420	3.925	16.870	32.986	1.221	29.847
COD Accepted Quantity	CAQUAN	81.717	441.050	3.891	88.089	97.307	8.930
Meter Set Quantity	MEQUAN	204.396	870.828	6.926	217.313	109.744	20.744
Postage Due	PD	60.101	366.719	3.138	53.442	31.256	9.559
Caller Service	CS						
Retail Mailing Supplies	MS	43.477	23.800	8.912	28.141	8.363	9.731
Change of Address/Forward	CF	30.120	82.918	3.308	10.526	18.911	2.421
Mailing Payments	MP	79.954	854.082	2.736	76.295	44.031	11.498
Phone Card Quantity	PCQUAN						
Box Rental Quantity	BRQUAN	126.527	352.569	6.738	117.775	72.906	13.793
Pre-Stamped	EC	10.388	31.251	1.858	7.258	10.775	2.211
Inquiry Quantity	IQQUAN	41.568	11.907	12.046	32.693	4.409	15.570
Other	OT	93.311	138.302	7.934	53.078	25.774	10.455
Passport Quantity	PPQUAN	151.233	730.318	5.596	158.676	427.392	7.675
Return Receipt Quantity	RRQUAN	10.333	63.275	1.299	18.249	12.588	5.143
Registered Quantity	RGQUAN	94.949	177.233	7.132	70.110	68.743	8 456
Special Services Int'l Registered	SIRQUAN	66.028	350.944	3.525	61.242	1.020	60.651
Restricted Quantity	RDQUAN	141.452	25.292	28.127			
Certified Quantity	CEQUAN	20.265	25.464	4.016	26.875	8.921	8.998
Insurance Quantity	INSQUAN	71.078	46.048	10.474	70.143	17.425	16.804
Special Services Cert Mailing	SCMQUAN						
GH General	GVP	63.477	32.399	11.152	52.210	14.752	13.593
GH Parcel Quantity	GPDQUAN						
Wrong Address	WA						
Returned Mail	RM						
Payment by Check	CHECK	53.073	27.608	10.101	34.395	6.311	13.691
Payment by Credit Card	CREDIT	112.334	287.688	6.623	102.862	33.826	17.686
Adjusted R-Squared		0.366			0.424		