USPS-RT-5

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

Postal Rate and Fee Changes, 1997	Docket No. R97-1

REBUTTAL TESTIMONY OF
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ON BEHALF OF
UNITED STATES POSTAL SERVICE

TABLE OF CONTENTS

PURPOSE AND SCOPE 1

I. THE VARIABLES USED IN THE ORIGINAL REGRESSION ANALYSIS ARE APPROPRIATE FOR MEASURING THE VARIABILITY OF MAIL PROCESSING LABOR HOURS. 1

A. Labor Hours Are the Appropriate Dependent Variables in the Econometric Equations. 1

1. The specific concerns articulated by Dr. Neels are based upon misconceptions. 3

2. Dr. Neels' concerns, if accurate, would be applicable to the old approach used by the Postal Service and the Postal Rate Commission. 7

B. Piece Handlings Are the Appropriate Cost Drivers for Econometric Variability Equations 9

II. THE MODS DATA ARE PLENTIFUL AND REPRESENT OPERATING DATA. AS BOTH BRADLEY'S AND NEEL'S RESULTS DEMONSTRATE, THEY ARE RELIABLE FOR ESTIMATING VARIABILITIES. 12

III. THE ERRORS-IN-VARIABLES ANALYSIS DEMONSTRATES THERE IS A SMALL AMOUNT OF ERROR VARIANCE. THE ANALYSIS IS NOT AS MYSTERIOUS AS DR. NEELS SUGGESTS. 19

IV. DR. NEELS' AND DR. SMITH'S APPARENT INABILITY TO INTERPRET THE ECONOMETRIC EQUATIONS IS JUST A SMOKESCREEN. 23

A. The Use of Time Trends is the Standard and Appropriate Method to Capture All Time Varying Non-Volume Influences on Hours. 23

B. Both Dr. Smith and Dr. Neels Resurrect the "Criticism of Last Resort": The False Claim that the Econometric Analysis is "Short Run." 26

V. THE FUNDAMENTAL RECOMMENDATIONS MADE BY DR. SMITH AND DR. NEELS ARE SPECULATIVE. WHEN THEY ARE IMPLEMENTED, THE RESULTS SUPPORT MAIL PROCESSING VARIABILITIES BELOW ONE HUNDRED PERCENT. 29

A. The Simple Cross-Sectional Model is Biased. 29

B. Data on Capital Variables Are Available at the Facility Level. . . . 30

C. A Cross-Sectional Analysis with Capital Controls for Facility Specific Effects and Corroborates the Fixed-effects Model. 31

LIBRARY REFERENCES

The following Library References are sponsored by me and should be considered incorporated by reference in my testimony:

USPS LR-H-344	Econometric Programs to Calculate a Variability Based upon a 26 Accounting Period Scrub.
USPS LR-H-345	Errors-in-Variables Analysis Using 13 Period Differences.
USPS LR-H-346	Econometric Programs and Data to Estimate an Unbiased Cross-Sectional Variability.

PURPOSE AND SCOPE

The purpose of my testimony is to illuminate, clarify, and correct certain misconceptions, misstatements, and mistakes contained in the testimonies of United Parcel Service witness Neels (UPS-T-1) and OCA witness Smith (OCA-T-600). Because of the range and degree of misleading and erroneous statements in these testimonies, it is beyond the scope of my testimony to rebut them all. Consequently, the balance will be addressed by Professor John Ying in his testimony, USPS-RT-4.

I. THE VARIABLES USED IN THE ORIGINAL REGRESSION ANALYSIS ARE APPROPRIATE FOR MEASURING THE VARIABILITY OF MAIL PROCESSING LABOR HOURS.

Dr. Neels presents some apparent concerns about the use of hours as the dependent variable in the econometric equations and the use of TPH as the cost driver. These concerns are misplaced and unfounded, and seem to arise from a lack of familiarity with postal operations and staffing, and from a basic misunderstanding of postal costing.

A. Labor Hours Are the Appropriate Dependent Variables in the Econometric Equations.

Dr. Neels spends a surprising amount of time in his testimony expressing his concern about the use of labor hours as a dependent variable in the econometric regressions used for measuring variability.[1] He starts from the obvious fact that accrued costs are measured in dollars and thus represent the multiplication of hourly wage rates and total hours worked. From that basic point Dr. Neels develops a concern that if one uses hours as the dependent variable in an econometric variability equation, one must be missing "something." These fears are unfounded, as they are based upon confusing the level of accrued cost with the variability of accrued cost. While it is true that wages play an important role in determining the level of accrued cost, they do not play such a role in determining its variability.

The reason for this difference is simple. Labor time, as measured by hours, responds to small, sustained changes in volume, but wage rates do not. As Dr. Neels acknowledges, wage rates are set by periodic, multi-year national contracts between the Postal Service and its unions.[2] The contracts do not depend on small, sustained volume changes. This basic fact undercuts Dr. Neels apparent concern, so to generate an issue he is forced to depend upon some speculations about the variations in wages and hours. As I demonstrate below, these speculations are off the mark suggest a misunderstanding of postal operations by Dr. Neels.

More generally, the assertion by Dr. Neels that labor time should not be used as the dependent variable in a variability equation reflects his unfamiliarity

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[1] Direct Testimony of Kevin Neels on Behalf of United Parcel Service at 8, Tr. 28/15594.

[2] Tr. 28/15696-97.

with postal costing. In fact, this is not a new issue and labor time has already been used as a dependent variable in a variability equation by many different cost analysts and the Postal Rate Commission. Empirical studies of load time, the time spent loading pieces of mail into a variety of mail receptacles (which is quite similar to manual mail processing), have already related labor time to the pieces handled.

Studies by UPS witness Michael Nelson, MOAA et. al. witness Gary Andrew, ADVO witness Norman Lerner and the Postal Rate Commission itself all used labor time as the dependent variable and pieces handled as the cost driver.[3] This is the same approach that I follow in specifying the mail processing equations. Note that this approach of specifying labor time as function of pieces handled is not just an assumption, but rather it is part of a data analysis examined on the record in several omnibus rate cases.[4]

1. <u>The specific concerns articulated by Dr. Neels are based upon misconceptions</u>.

Dr. Neels first concern is that hours should not be used as a dependent variable because average wage rates can vary from facility to facility. He states:

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[3] <u>See</u>, for example, "Direct Testimony of Gary M. Andrew on Behalf of MOAA et.al.," Docket No. R90-1, "Direct Testimony of Michael A. Nelson on Behalf of United Parcel Service," Docket No. R90-1, "Direct Testimony of Norman on Behalf of ADVO," Docket No. R90-1, and PRC Op., R90-1 at III-85.

[4] It is true that the dependent variable in those studies measured time in minutes or seconds and the dependent variable in the mail processing equations measure time in hours. Dr. Neels did not object to the unit of measurement in labor time.

> This schedule of wages may be higher or lower, depending upon the labor market, inflation, collective bargaining agreements and other factors. All else equal, the higher the wage rates, the higher the average compensation per hour will be.[5]

It is true that costs vary across sites when wages vary but, as explained above, a variability analysis measures how costs vary when volume varies. Wages are not a function of volume, particularly not small sustained changes in volume. Moreover, the fact that wages are varying across sites for reasons other than volume means that using dollar costs as the dependent variable in a variability equation would make finding the correct variability more difficult. That is because, in doing so, one would have to accurately control for all of the non-volume variation in wages. It is also important to recognize that Dr. Neels' approach of using dollar cost does not require a measure of average wages in the facility. Instead, it requires a measure of the average wages in each activity in each facility. These, in particular, do not vary with small changes in volume.

Dr. Neels' second concern about using hours as the dependent variable arises because he believes that the mix of hours varies from facility to facility:

> Average compensation per hour will also be influenced, however, by the *mix* of hours at a facility. (Emphasis in original).[6]

This concern is misplaced because the mix of hours within a facility does

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5 Neels at 8.

6 Neels at 9.

not matter for an econometric analysis at the level of the activity. While it is possible that different facilities could have different mixes of activities and thus different mixes of labor hours, the type of hours within an activity will be the same from facility to facility. Moreover, even if they were not, this is exactly the type of site-specific heterogeneity that a fixed-effects model will control for. If Dr. Neels' concern were accurate, it would undermine only the use of a cross-sectional model, not a fixed-effects model.

Dr. Neels' third concern is that the mix of hours within a facility may change and costs can vary when the mix of hours varies.

> While one might argue that the schedule of wage rates is determined largely by general labor market conditions rather than by mail volume, the same cannot be said for the mix of types of time. There are a number of reasons for believing that the mix of hours at a facility might vary systematically with volume.[7]

Dr. Neels makes two mistakes here. First, he again confuses the requirements for an econometric analysis performed at the activity level with characteristics of labor at the facility level. Variations in volume simply do not cause variations in the mix of labor at any point in time, in a given activity.

In addition, Dr. Neels argues that there may be overtime paid in high volume periods and that this would affect the dollar cost pool.[8] He argues that

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7 Neels at 10.

8 Neels at 9.

the dependent variable should include these effects. But Dr. Neels yet again confuses variations in non-volume factors with volume variability. If overtime is needed to handle seasonal peaks, these variations in costs are not caused by small, sustained increases in volume and including them in the dependent variable would cloud, not clarify, the accurate measurement of volume variability. These variations are there year after year, even if the overall volume level stays the same. That is, these types of variations are seasonal, not volume variable. One should control for seasonal variations in hours, as I do in my econometric equations, but there is no reason to complicate the process of finding the true volume variability by adding an additional seasonal variation to the data.

Dr. Neels' fourth concern is that hours are not comparable through time:

> While it is true that by focusing on hours Bradley has eliminated changes in costs that are associated with shifts in the overall wage schedule rather than volume, it is *not* true that the resulting measure of hours is comparable across sites or across time, a precondition for the use of hours as proxy for costs. The hours of supervisory personnel and skilled craftsmen are not the same as the hours of unskilled casual workers. (Emphasis added).[9]

Here Dr. Neels makes a mistake because he does not seem to understand Postal Service staffing. Supervisory personnel and skilled craftsmen are not assigned to work in basic mail processing operations. In fact, the type of labor used within a given mail processing activity is homogenous through time. Over time, supervisors don't start running OCRs and mail handlers do not start

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[9] Neels at 11.

sorting mail. Hours within an activity are comparable through time.

2. Dr. Neels' concerns, if accurate, would be applicable to the old approach used by the Postal Service and the Postal Rate Commission.

It would seem that Dr. Neels has not completely thought through the implications of his concerns. He is arguing that hours should not be used as the dependent variable in an econometric variability equation because it misses the variation in costs caused by the response of wages to small sustained volume increases. In sum, he argues that he variability of wages with respect to volume is not zero.

But consider two arguments he makes in his testimony. First, he argues that "simple plots" show that labor hours are proportional to piece handlings.[10] Elsewhere, he argues that the Commission should assume that mail processing labor costs are proportional to volume.[11] Because costs are just equal to the product of wages and hours, we can calculate the mathematical conditions required for both assertions to hold. Define cost (C) as the product of wages (w) and hours (H). Then the elasticity of wages with respect to volume is given by:

$$\varepsilon_{C,v} = \frac{\partial (wH)}{\partial v} * \frac{v}{wH}. \quad (1)$$

[10] Tr. 28/15760.

[11] Neels at 48.

Expanding the derivative yields:

$$\varepsilon_{C,v} = \left(\frac{\partial w}{\partial v} * H + \frac{\partial H}{\partial v} * w \right) \frac{v}{wH}. \quad (2)$$

Dividing through by wH yields:

$$\varepsilon_{C,v} = \left(\frac{\partial w}{\partial v} * \frac{H}{wH} + \frac{\partial H}{\partial v} * \frac{w}{wH} \right) v. \quad (3)$$

Simplifying terms:

$$\varepsilon_{C,v} = \left(\frac{\partial w}{\partial v} * \frac{v}{w} + \frac{\partial H}{\partial v} * \frac{v}{H} \right). \quad (4)$$

This expression shows that the elasticity of cost with respect to volume is the sum of the elasticity of wages with respect to volume plus the elasticity of hours with respect to volume:

$$\varepsilon_{C,v} = \varepsilon_{w,v} + \varepsilon_{H,v}. \quad (5)$$

If, as Dr. Neels has suggested, the elasticity of costs with respect to volume and the elasticity of hours with respect to volume are both 100 percent, then the only way that both of Dr. Neels' assertions could be true is if the elasticity of wages with respect to volume is zero. Unfortunately, this condition directly contradicts his concerns about using mail processing hours as a dependent variable in a variability equation.

The mathematical exercise also demonstrates that the old approach to volume variable mail processing labor cost, in which a variability of 100 percent was assumed, relies upon the condition that the elasticity of wages with respect to volume is zero.

B. Piece Handlings Are the Appropriate Cost Drivers for Econometric Variability Equations.

Dr. Neels' apparent misunderstanding of how postal costs are generated also seems to lead him to his erroneous conclusion that piece handlings are not appropriate cost drivers for the econometric variability equations. In fact, even his "bedrock" assertion is erroneous. In opening his argument Dr. Neels states:

> It is also obvious that an econometric study of the variability of mail processing costs with changes in volume should involve an analysis of changes in the volume of mail delivered.[12]

But, of course this is not obvious. Anyone with a basic knowledge of mail processing knows that there are material volumes of mail that are delivered that essentially bypass mail processing.[13] The volume of mail delivered might be appropriate for a carrier street time analysis, but not for a mail processing analysis.

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[12] Neels at 12.

[13] In addition, there are the volumes of mail that receive mail processing but are picked up by customers at postal facilities.

More generally, Dr. Neels is apparently unaware of the widely used practice of using cost drivers for measuring cost elasticities or variabilities. Activity-specific volumes are rarely available by postal activity and often it is not feasible to collect this information. The use of a cost driver has been used in many cost components including city carrier load time, purchased highway transportation, rural carriers, window service, city carrier access time, vehicle service drivers, and now mail processing.

In trying to justify his misplaced concern, Dr. Neels, unfortunately, makes a few more mistakes. First, he worries about the fact that some pieces of mail require more handlings than others. This is, however, an argument in favor of using a cost driver, like piece handlings, for determining variability. It is the characteristic that different classes of mail differentially participate in the various mail processing activities that rules out the use of raw originating volumes in measuring the variability of mail processing labor costs.

Dr. Neels also has a misplaced worry about the possibility that the relationship between piece handlings and volume can change through time. The Postal Service approach to costing does not assume constancy in this relationship. In fact, as explained by witness Degen and witness Christensen, by using the most recent years data to for the distribution key, the Postal Service approach explicitly allows for variation in the relationship between piece handlings and volume through time.

Fundamentally, Dr. Neels just does not seem to understand how postal costs are incurred and seems unfamiliar with the way the Postal Service and the

Postal Rate Commission measure volume variable costs. This is revealed in his statement that:

> Bradley has provided no information on the relationship between piece handlings and volume.[14]

While this is factually correct, it is misleading. Although my testimony did not present information on the relationship between piece handlings and volume, the Postal Service has presented such information. Moreover, there was no reason for me to present such information because, as I explained in my testimony, I investigated the "attribution step," which determines the variability of cost with respect to the cost driver. The "distribution step," in which the relationship between the cost driver and mail volume is addressed by witness Degen.

Dr. Neels further compounds the confusion on this issue by suggesting that this type of information is required only for my variability analysis:

> Without such information the Commission cannot determine what his piece handling variability estimates imply for the volume variability of mail processing costs.[15]

In fact, information about the relationship between mail volume and piece handlings is required for any variability analysis the Commission chose to use, including the historical assumption of 100 percent variability. To understand this

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[14] Neels at 14.

[15] Neels at 14.

point, suppose that my econometric equations had supported, rather than rejected, the assumption that hours are proportional to piece handlings. The Commission would still have to "worry" about the relationship between piece handlings and volume.

II. THE MODS DATA ARE PLENTIFUL AND REPRESENT OPERATING DATA. AS BOTH BRADLEY'S AND NEEL'S RESULTS DEMONSTRATE, THEY ARE RELIABLE FOR ESTIMATING VARIABILITIES.

For the first time, participants in this proceeding have the data necessary to test the assumption that the variability of mail processing labor costs is 100 percent. The data are MODS data and have two distinct advantages. First, they are operational data. These data reflect the actual generation of hours from the handling of actual pieces. This means they are an excellent empirical basis for identifying the causality between work done and the cost required to accomplish that work.

Second, the MODS data are plentiful. In most cases, there are tens of thousands of data points available for estimating an econometric regression. This wealth of data has two implications. The analyst can be judicious in the use of the data because there is so much available. In many econometric studies, the analyst must decide which data to include and which to exclude from the regression. When the analyst has only hundreds of data points, there is pressure to retain data to ensure sufficient degrees of freedom. When the analyst has tens of thousands of observations, the balance should be placed on improving the quality of the data relative to increasing the raw quantity.

Curiously, even with tens of thousands of observations, Dr. Neels seems to prefer quantity over quality. Despite indicating his belief that some of the MODS data points contain errors, he argues that an analyst should rely upon every single point![16] As I have explained, some of the MODS data points imply throughput rates on machines that are physically impossible. Nevertheless, Dr. Neels advocates using those data points in his regressions. The amazing thing about his approach to data use is that even though he uses data known to contain errors, his econometric results corroborate the results from the scrubbed data and imply a strong rejection of the hypothesis that the volume variability of mail processing labor is one hundred percent.

The choice of including or excluding data from an analysis invariably involves the use of judgement. In direct contrast to Dr. Neels' abuse of the term "scientific method" [17] the Commission has long understood this point:

> The econometrics literature does not generalize that deleting outliers is appropriate or inappropriate. <u>This is a matter of judgement</u>, and turns on the specific properties of the data and model being applied.[18] (Emphasis added).

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[16] Neels at 46.

[17] Dr. Neels expressed the strange notion that replication requires both the ability to understand and reproduce a previous scientist's work and the requirement that the replicator <u>agree</u> with each of the research decisions made by the original scientist. <u>See</u> Neels at 33. To anyone familiar with scientific, particularly econometric, research this is a curious notion indeed.

[18] PRC Op., R90-1, at III-76.

It was, and is, my opinion that, (1) given the fact that the MODS data are operating data and (2) given the large amount of data available, the use of data scrubs is prudent and appropriate. I recognize that some judgment is required, particularly in the choice of a minimum of three years of data to ensure representativeness of a site's data. To investigate the robustness of that decision, I have re-estimated all of the MODS direct operation equations with a different, less restrictive scrub. In this alternative approach, I required a site to have only two years of continuous data to be included in the analysis.[19] The variabilities estimated by this process are presented in Table 1. That table shows the results are very robust to alternative scrubs.

Dr. Neels tries to make hay about the differences between his results based upon error-laden data and my results based upon clean data. In a misleading statement, he mentions only that his results generate higher variabilities. In fact, as he was forced to admit, his results sometimes provide higher variabilities and sometime provide lower variabilities.[20]

An overall assessment of his results shows that he actually provides corroboration for my results. Quite naturally, his results show more variation between the highest and lowest variabilities because they include observations that include data errors. One would expect such data points to increase the

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[19] The detailed programs and results are presented in Library Reference H-344, Econometric Programs to Calculate a Variability Based upon a 26 Accounting Period Scrub.

[20] Tr. 28/15719-20.

Table 1
Comparison of Econometric Results from a 39 AP Scrub
and a 26 AP Scrub

	Manual Letters		Manual Flats		OCR		BCS		LSM		FSM		SPBS Priority		SPBS Non-Priority		Manual Priority		Manual Parcels		Cancel & Mtr. Prep	
	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs	>= 39 APs	>=26 APs
Pieces	0.772	0.770	0.748	0.762	0.628	0.635	0.774	0.767	0.869	0.872	0.781	0.784	0.619	0.598	0.370	0.354	0.403	0.407	0.300	0.308	0.566	0.569
Lagged Pieces	0.025	0.028	0.118	0.128	0.158	0.164	0.172	0.177	0.036	0.034	0.138	0.135	0.183	0.182	0.098	0.091	0.045	0.049	0.095	0.092	0.089	0.099
Manual Ratio	-0.166	-0.171	-0.249	-0.272	0.005	0.014	0.047	0.051	-0.008	-0.012	0.040	0.044	na	na	na	na	na	na	na	na	na	na
Time Trend 1	-0.001	-0.001	0.001	0.001	-0.005	-0.006	-0.002	-0.002	-0.001	-0.001	-0.001	-0.001	-0.003	-0.004	0.004	0.003	0.003	0.003	0.004	0.004	0.004	0.004
Time Trend 2	0.001	0.001	0.000	0.000	0.006	0.006	0.002	0.002	0.003	0.003	0.005	0.005	0.001	0.000	0.003	0.003	0.012	0.010	0.001	0.001	-0.001	-0.001
ρ	0.737	0.739	0.754	0.753	0.810	0.801	0.798	0.793	0.731	0.721	0.749	0.748	0.676	0.692	0.810	0.799	0.776	0.762	0.794	0.789	0.822	0.374
S.E.R.	0.092	0.095	0.083	0.083	0.011	0.109	0.098	0.099	0.045	0.047	0.059	0.060	0.200	0.209	0.109	0.124	0.189	0.193	0.210	0.219	0.098	0.104
R^2.	0.984	0.983	0.985	0.985	0.945	0.947	0.977	0.977	0.995	0.995	0.986	0.986	0.860	0.843	0.889	0.883	0.944	0.946	0.890	0.887	0.966	0.968
# Obs.	24,781	25,319	23,989	24,389	18,497	18,957	22,737	22,984	19,734	20,008	17,943	18,158	1,967	2,501	4,569	5,758	15,736	16,311	17,345	18,058	19,557	20,848
# Sites.	309	327	300	324	234	254	287	304	239	254	219	234	30	47	63	94	201	232	234	262	253	291
Avg. Pieces (1,000s)	9,235	9,119	3,593	3,493	15,454	15,039	37,572	37,379	23,980	23,413	5,889	5,821	688	647	1,419	1,332	707	666	252	246	15,389	14,873
last:	0.797	0.797	0.866	0.890	0.786	0.799	0.945	0.944	0.905	0.905	0.918	0.919	0.802	0.780	0.469	0.445	0.448	0.456	0.395	0.400	0.654	0.668

variation in the results. But, there is no mistaking the pattern of similarities. In those activities in which I estimated high variabilities, Dr. Neels estimates high variabilities. In those activities in which I estimated low variabilities, so does Dr. Neels.

If one compares my original results, my revised results based upon the two year scrub, Dr. Neels' results, and the untested assumption of one hundred percent variability, it is clear which set of results is the outlier — the assumption of one hundred percent volume variability. Figure 1 makes this point graphically.

One final issue on this subject requires attention. In discussing my scrubs, Dr. Neels decries the "throwing out" of 10 percent or 20 percent of the data. Yet, in his "recommended" variabilities to the Commission, Dr. Neels ends up "throwing out" over 98% of the data. By collapsing all the data for a single site down to one point, Dr. Neels throws out a tremendous amount of information, just as surely as if had thrown away the observations. Keep in mind that a cross-sectional analysis is performed with just one observation for each site; a cross-sectional analysis could be performed, for example, on only the last accounting period of data for each site. Seen in this way, it is clear that a cross-sectional approach throws out all data points for a site, but one. Table 2 shows the dramatic loss of information created by Dr. Neels' avowed approach.

Table 2 Number of Observations used to Estimate the Variability				
Activity	Observations. with Complete Data	Bradley USPS-T-14	Neels UPS-T-1	Reduction in Data Set Size in Neels UPS-T-1
Manual Letter	28,648	24,781	425	-98.5%
Manual Flat	28,504	23,989	421	-98.5%
OCR	21,345	18,497	305	-98.6%
BCS	26,426	22,737	380	-98.6%
LSM	23,251	23,919	321	-98.6%
FSM	21,544	17,943	285	-98.7%

III. THE ERRORS-IN-VARIABLES ANALYSIS DEMONSTRATES THERE IS A SMALL AMOUNT OF ERROR VARIANCE. THE ANALYSIS IS NOT AS MYSTERIOUS AS DR. NEELS SUGGESTS.

Dr. Neels seems to be a bit confused by the errors-in-variables analysis contained in my testimony and admits that the reasons for what he calls "anomalous" results are "not completely clear" in his mind.[21] Perhaps the results seem "anomalous" to Dr. Neels because he has an incomplete understanding of errors-in-variables analysis. This lack of understanding is suggested by his erroneous statement that measurement error necessarily causes the estimated variability to be less than the "true" variability.[22] Of course, it is well known that this is not true:

> One can calculate the nature of the bias in β by making different assumptions about the different covariances. We need not pursue this further here. What is important to note is that one can get either underestimation or overestimation of β.
>
> With economic data where such correlations are more the rule than an exception, it is important not to believe that the slope coefficients are always underestimated in the presence of errors in observations, as is suggested by classical analysis of errors-in-variables models.[23]

It is this misunderstanding that probably lies underneath Dr. Neel's misguided attempt to assign the differences between what he calls the "automatic"

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[21] Neels, Appendix A, at A-3.

[22] Neels p. 19 and Appendix A at page A-3

[23] C. S. Madalla, Econometrics, McGraw Hill, 1977, New York, at 302

variabilities and manual variabilities to measurement error.[24] Another part of his confusion may lie in just not understanding the way the data are collected. This confusion causes him to misstate when an errors-in-variables analysis is required. Dr. Neels seems to think that the TPH recorded in automated and mechanized operations are the sum of FHP and subsequent handling pieces (SHP).[25] But this is simply wrong. The TPH for mechanized and automated operations are taken directly from machine counts and are <u>not</u> downflows from FHP. Any concerns about the FHP measure do <u>not</u> affect these TPH and the TPH for mechanized and automated operations are not subject to potential measurement error.

Dr. Neels also seems puzzled by the calculation of a negative measurement error variance from the errors-in-variables (EIV) formula. While it is true that an *estimated* variance will not be negative, a *calculated* one certainly can be. In the instant case, the reason for this result is quite simple. The formula for calculating the variance depends upon the difference between the fixed-effects estimator and the first difference estimator. In the case of the manual letter sorting activity, the first difference estimator happens to be slightly higher than the fixed-effects estimator. There is nothing "mathematically

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[24] As Dr. Neels admits (Tr. 28/15225), when there are several possible reasons why estimated variabilities differ, one needs more information than the variabilities themselves to explain the difference. Given his admitted lack of understanding of postal operations, Dr. Neels apparently defaults to the erroneous idea that differences are due measurement error, under the false assumption that measurement error must bias the coefficients downward.

[25] See Neels at 16.

impossible" about this result, it is straightforward.[26]

Furthermore, it is no mystery how this result would occur. When the variable measured with error (here, TPH) is serially correlated, the relationship between the size of the fixed-effects estimator and the first difference estimator is ambiguous:

> Then, for the case T=3, the (fixed-effects) estimator is less biased than the first difference estimator if $(\rho_1-\rho_2)/(r_1-r_2) > (1-\rho_1)/(1-r_1)$ which holds if the serial correlation in the true variable decreases less slowly than the serial correlation in the measurement error. This type of condition generalizes to values of T larger than 3. While the condition seems plausible that $\rho_j > r_j$ and that the decrease in the serial correlation of the z's be less than for the v's, it is not overwhelming. Counterexamples are easy to construct. The particular case under consideration would need to be examined.[27]

Thus, if Dr. Neels had actually been interested in deriving a non-negative value for the variance of the measurement error, he could have accounted for possible serial correlation in TPH by calculating the errors-in-variables estimator for a "long" distance. For example, one can compare the fixed-effects estimator

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26 The weakness in Dr. Neels arguments is revealed by his attempt to have me call the errors-in-variables estimator the "true" variability. Despite my rejection of the point under cross examination, Dr. Neels continues to attempt to put those words in my mouth. <u>See</u> Neels at page A-3, especially footnote 26. I have not argued that the errors-in-variables analysis present the "true variabilities," otherwise I would have recommended them to the Commission. Rather, the errors-in-variables analysis shows that measurement error is not a stumbling block in estimating the variabilities.

27 "Errors in Variables in Panel Data," Zvi Griliches and Jerry Hausman, <u>Journal of Econometrics</u>, Vol. 31, No. 1, Feb. 1986 at 93-118.

with the one year (13 accounting period) differences. That analysis is presented in Table 3.[28] Tt can be seen there that Dr. Neels' anxiety about a negative calculated variance is dispelled. Moreover, even with a 13 period lag, the errors-in-variables variability supports an absence of large and material measurement error.

Table 3 Econometric Results for the Errors-in-Variables Analysis With a 13 Period Difference		
	Manual Letter Sorting Activity	Manual Flat Sorting Activity
Fixed-effects β	0.6266	0.6972
13 Period Difference β	0.5222	0.6413
Errors-in-Variables β	0.7364	0.7353
Variance of TPH	0.0716	0.0881
Calculated Variance of Measurement Error	0.0152	0.0046

[28] The details of the errors-in-variables analysis is presented in USPS Library Reference H-345, Errors-in-Variables Analysis Using 13 Period Differences.

IV. DR. NEELS' AND DR. SMITH'S APPARENT INABILITY TO INTERPRET THE ECONOMETRIC EQUATIONS IS JUST A SMOKESCREEN.

Perhaps because they can produce no factual basis for criticizing my econometric equations, both Dr. Smith and Dr. Neels claim difficulty in interpreting the regression results. For example, both seem to be puzzled by the time trend variables and they both fall back upon the old canard of "short run" vs. "long run."

A. The Use of Time Trends is the Standard and Appropriate Method to Capture All Time Varying Non-Volume Influences on Hours.

There is a long history of using time trends to capture technological and other time-varying effects in econometric models. Even Dr. Smith admitted that this is done in both microeconomics and macroeconomics.[29] However, despite my clear indications that the time trends capture technological and other factors that influence hours through time, Dr. Neels oddly attempts to refute the notion that the time trends capture only technological change.[30] Dr. Neels also admits that he is not familiar with the basic econometric terms that describe this type of trend modeling, so perhaps it should not be surprising that he has difficulty interpreting the trends.[31] At the same time, Dr. Smith finds himself unable to

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[29] Tr. 28/15904-06.

[30] For example, see Neels at 39, where he states "I do not believe that his time trend coefficients are really picking up the effects of technological progress."

[31] Dr. Neels states that he is unfamiliar with the econometric terms that describe the trend modeling approach: segmented trend and shifting trend.

interpret the time trend coefficients.[32] Fortunately for the Commission, this inability to understand the time trends is not universal. Witness Shew finds the information contained in the time trends to be "relatively simple" and "interesting."[33]

Both Dr. Smith and Dr.Neels seem to ignore the fact that the time trends are control variables; the time trends control for non-volume time varying effects. They are not the only way to control for these factors and both Dr. Neels and Dr. Smith ignore the fact that I also estimated the model without shifting trends. In USPS-T-14, I presented an alternative analysis with a simple time trend and time-period-specific effects in place.[34] The results of this alternative analysis produces variabilities well below 100 percent and generally lower than my recommended variabilities. This proves that my econometric results are not dependent on the specific time trend employed.

Moreover, both Dr. Smith and Dr. Neels are confused about what has been tested relative to time-period-specific effects. After reviewing PRC/UPS-XE-1, both seemed to suggest that time-period-specific effects had not been

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(Tr. 28/15709). For a discussion of these terms see "Shifting Trends, Segmented Trends and Infrequent Large Shocks," Nathan Balke and Thomas Fomby, Journal of Monetary Economics, Aug. 1991, at 61-86

[32] See Smith at 15, "I am unable to conclude what the external effects measure or why they are positive or negative."

[33] See Direct Testimony of William B. Shew on Behalf of Dow Jones & Co, DJ-T-1, at 16, Tr. 28/15518.

[34] See USPS-T-14 at 72.

tested against a pooled model that did not allow such effects.[35] In fact, this is false. The Gauss Newton Regression tests calculated for my direct testimony indicated rejection of the null hypothesis of no time-period-specific effects. That is why I explicitly included time-period-specific effects in the form of the trend modeling and why I estimated the two-way model. The two-way model, for example, explicitly allows for both facility-specific effects and time-period-specific effects.

Furthermore, one of the advantages of the trend model I specified is that it is general enough to allow the overall TPH "slope" coefficient, the change in hours with respect to TPH, to vary through time. It is thus inaccurate to suggest that the fixed-effects models presented in USPS-T-14 do not include any time indexed coefficients.[36]

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35 Tr. 28/15776, Tr. 28/15805, and Tr.28/15960.

36 In terms of PRC/UPS-XE-1 (Tr. 28/15776), this means that there has been testing of "the right hand flow."

B. Both Dr. Smith and Dr. Neels Resurrect the "Criticism of Last Resort": The False Claim that the Econometric Analysis is "Short Run."

Dr. Smith and Dr. Neels are both new to Commission proceedings and both have indicated that they have not reviewed the record of past proceedings and have not read many previous Recommend Decisions.[37] If they had, they would know that the Commission long ago faced the apparently difficult of "short run" and "long run." As the Commission understood then, and as I am sure that it understands now, this debate is a tempest in a teapot.

Economists define the "long run" as the ideal state in which all inputs are perfectly optimized and the firm is producing along at its minimum possible cost level. Given the nature of the enterprise and given the collective bargaining structure, it is fair to say that the Postal Service is not yet in this idealized state. Thus, any economist would have to agree that, by the strict economists' definition, Postal Service costs are not "long run." It is in this context that I correctly stated that postal costs are "short run."

This does not mean that I am talking about the costs for one day, one week, or one month when I use the term "short-run." Short-run costs may last for many years and may certainly last longer than the period of time for which rates are in force. That is why we all should follow Professor Baumol's advice and focus on the <u>actual</u> marginal costs. Those are the costs measured by my econometric analysis.

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[37] Tr. 28/15903 and Tr. 28/15665.

Dr. Smith, for example, seems to suggest that in mail processing, the long run would be reached in one year:

> Based on witness Bradley's comments, it appears that the longer-run for the mail processing activities under consideration is approximately a year, given the Postal Service's extensive ongoing capital programs.[38]

Given Dr. Smith's time frame, there can be no doubt that my econometric results are "longer-run." One need only look at page 76 of USPS-T-14 to find a set of econometric results based upon annual data. Each data point in that analysis represents a "long run" period by Dr. Smith's definition, so an econometric analysis spanning many long-run periods can be nothing but long run. These annual results also rebut Dr. Neels claim that the results in USPS-T-14 are short run because they are based upon accounting period data:

> The fixed effects models that Bradley relies upon for his variability estimates do not appear to be capable of providing reliable estimates of the long-run variability of mail processing labor costs. Those models relate mail processing labor hours in a four-week accounting period to the number of piece handlings in that same period and in the previous period. Because these models look back only a single accounting period, they are not capable of detecting or accounting for the changes that take place over a longer period of time.[39]

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[38] Direct Testimony of J. Edward Smith Jr, On Behalf of the Office of the Consumer Advocate at 16, Tr 28/15836-37.

[39] Neels at 39.

Dr. Neels also seems to have missed the end of my testimony in which I present fixed-effects models estimated on annual data. The annual analysis certainly avoids his perceived problem with "short run data."

It is more important, however, to recognize the Dr. Neels' statement is not correct. The frequency of the data does not determine whether the analysis is "short run" or "long run." Dr. Neels is apparently referring to the old comparison of a cross-sectional data set across many sites with a single time series data set from one site. Under certain circumstances, the cross-sectional data would be considered long run whereas the time series data would be considered short run. Upon a moments reflection, it becomes clear that this old comparison is not relevant for panel data. In a panel data set, one has a time series of observations for <u>all</u> sites. A panel data set is a set of repeated cross-sections and can certainly generate long run results. Dr. Neels would have the Commission believe that by taking nine years of experience at a site and collapsing all that information into a single data point, one can magically generate "long-run" results. Obviously, the elimination of information does not generate long-run results.

Dr. Neels also claims that his cross-sectional variabilities are higher than the fixed-effects variabilities because they are "long-run." As I demonstrate in the next section, this unsubstantiated claim is false. Dr. Neels' cross-sectional variabilities are higher because they are biased, not because they are long run. An unbiased cross-sectional model provides variabilities that corroborate the fixed-effects results.

V. THE FUNDAMENTAL RECOMMENDATIONS MADE BY DR. SMITH AND DR. NEELS ARE SPECULATIVE. WHEN THEY ARE IMPLEMENTED, THE RESULTS SUPPORT MAIL PROCESSING VARIABILITIES BELOW ONE HUNDRED PERCENT.

Dr. Neels' fundamental recommendation is that the Commission should pursue a cross-sectional analysis. Dr. Smith's fundamental point is that the fixed-effects model should be extended to include a capital variable.[40] In this section of my testimony I consider these recommendations and show the effect of implementing them.

A. The Simple Cross-Sectional Model is Biased.

In the presence of facility specific characteristics, a simple cross-sectional model is biased. Consider a simple panel data model:[41]

$$y_{it} = \alpha_i^* + \beta x_{it} + \mu_{it}, \quad i = 1,\ldots,N; \quad t = 1,\ldots,T. \qquad \textbf{(6)}$$

In this model the α^* are the facility-specific effects. Suppose one would attempt to estimate this equation by OLS on cross-sectional data. Because of the limited data point, doing so requires estimating a single intercept term and requires dropping the facility-specific variables, as Dr. Neels does.

It can be shown that the probability limit of the cross-sectional estimator is

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40 Dr. Smith also recommend the use of a "pooled" model. That model has already be soundly rejected on the record and bears no further consideration. Tr. 28/16081 and Tr. 29/16124-25.

41 This discussion is taken from Cheng Hsiao, Analysis of Panel Data, Cambridge University Press, 1986, Cambridge, at 63.

given by:

$$plim\ \hat{\beta}_{OLS} = \beta + \frac{Cov(x_{it},\alpha_i*)}{\sigma_x^2} \qquad (7)$$

where the bias arises because of the covariance between the right-hand-side variables and the omitted facility specific effects. It has already been established that the facility specific effects are correlated with TPH, the "x_{it}" in the above equation. Therefore, Dr. Neels' cross-sectional analysis is biased.

Although one cannot use the fixed-effects approach to control for facility-specific effects in a cross-sectional analysis, one could use data on actual variables to do so. If one knew the list of variables and collected data on them, they could be included in the cross-sectional analysis as a proxy for the facility specific-effects to mitigate the bias.

B. Data on Capital Variables Are Available at the Facility Level.

Dr. Smith has argued that mail processing labor equations should include some measure of capital. As I have explained before, it is possible to get some data on capital at the facility level, but such data are not available at the activity level. For example, the only capital in a manual letter operation would be the square footage of the building in which the operation was being conducted.[42] However, actual square footage by mail processing activity is not available. This

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42 The wooden cases used for sorting mail have long since been depreciated. Even new, their cost would be a trivial part of the activity's cost.

means if one wants to include capital in a mail processing labor equation, one must do it at the level of the facility. To consider Dr. Smith's recommendation, in concert with Dr. Neel's recommendation, I collected data on physical capital at the MODS facilities.

C. A Cross-Sectional Analysis with Capital Controls for Facility Specific Effects and Corroborates the Fixed-effects Model.

Because capital data are only available at the facility level, an unbiased cross-sectional analysis can only be estimated at that level. To ensure comparability, however, I first re-estimated the fixed-effects model at the facility level on the panel data used in USPS-T-14. In this baseline estimation I used total facility mail processing hours as the dependent variable. The model thus has the following form:

$$
\begin{aligned}
\ln HRS = & \left[\delta_1 + \delta_2 L\right] \ln TPH_L + \left[\delta_3 + \delta_4 L\right] (\ln TPH_L)^2 \\
& + \left[\delta_5 + \delta_6 L\right] \ln TPH_F + \left[\delta_7 + \delta_8 L\right] (\ln TPH_F)^2 \\
& + \left[\delta_9 + \delta_{10} L\right] \ln TPH_P + \left[\delta_{11} + \delta_{12} L\right] (\ln TPH_P)^2 \\
& + \left[\delta_{13} + \delta_{14} L\right] \ln TPH_{PR} + \left[\delta_{15} + \delta_{16} L\right] (\ln TPH_{PR})^2 \\
& \delta_{17} [\ln TPH_L * \ln TPH_F] + \delta_{18} [\ln TPH_L * \ln TPH_P] \qquad (8) \\
& \delta_{19} [\ln TPH_L * \ln TPH_{PR}] + \delta_{20} [\ln TPH_F * \ln TPH_P] \\
& \delta_{21} [\ln TPH_F * \ln TPH_{PR}] + \delta_{22} [\ln TPH_P * \ln TPH_{PR}] \\
& + \delta_{23} XMAS + \delta_{24} Q4 \\
& + \delta_{25} [t_1] + \delta_{26} [t_2] + \delta_{27} [t_1]^2 + \delta_{28} [t_2]^2 + \varepsilon
\end{aligned}
$$

In this equation, HRS represents all mail processing hours at a facility, TPH_L represents all letter TPH in a facility, TPH_F represents all flat TPH in a facility, TPH_P represents all parcel TPH in a facility, TPH_{PR} represents all Priority Mail TPH in a facility, XMAS is a seasonal dummy variable for the Christmas period, Q4 is a seasonal dummy variable for the fourth quarter, and t_1 and t_2 are the well-known time trends. Volume variability is measured by the sum of the coefficients on TPH_L, TPH_F, TPH_P, and TPH_{PR}. Estimation of this equation on the panel data set yields an overall variability of 66.3%.[43] As expected (due to scope

[43] For the details of the estimation process and the detailed results, please see USPS Library Reference H-346, Econometric Programs and Data to Estimate an Unbiased Cross-Sectional Variability.

economies) this is less than the system variability that I calculated using the disaggregated equations.

Data exist for three characteristics of facilities, their age, the number of mail processing square feet contained in the facility and the number of floors that perform mail processing. The most recent Fiscal Year for which these data are available is 1994.[44] Thus, a cross-sectional data set was constructed, at the facility level, using fiscal year 1994 data for hours and piece handlings. At first, equation (8) was estimated without any facility specific effects included. This replicates the cross-sectional model recommended by Dr. Neels.[45] As with his results, this generates a variability well over 100 percent.

When the capital variables are added, the bias is reduced, and the results approach the fixed-effects results. Table 4 presents the results. They make clear that Dr. Neels' extremely high variabilities are coming from omitted variables bias, not from a mysterious "long-run" effect. In addition, the results show that the facility-specific effects in a panel data model do a good job of capturing the effect of capital across facilities.

These results are based upon a limited amount of data and are not as accurate as the complete set of fixed-effects results presented in USPS-T-14, and I am not recommending that the Commission use them. They do provide

[44] The details of the data construction process as well as an electronic version of the data are included in USPS Library Reference LR-H-346.

[45] Because it is a cross-sectional model, the time trends and seasonal variables do not appear.

strong refutation of the speculations of Dr. Smith and Dr. Neels that the fixed-effects equations are mis-specified and short run. In addition, they once again demonstrate in dramatic fashion that any unbiased estimator of the volume variability of mail processing will produce a result showing that the variability is significantly less than one.

Table 4
Mail Processing Labor Variabilities
Derived from a Cross-Sectional Analysis with Capital

	Letter Coefficient	Flat Coefficient	Parcel Coefficient	Priority Coefficient	Variability
No Capital Variables Included	0.636	0.457	0.015	0.093	1.200
Adding Square Feet & Age	0.524	0.155	0.024	0.041	0.743
Adding Sq. Feet Age, and # of Floors	0.529	0.173	0.024	0.035	0.761

Finally, these results explain the apparent variation in variabilities presented in PRC/UPS XE2.[46] Those results showed that two sets of Dr. Neels' results matched quite closely with my results, but one set, the cross-sectional set, produced variabilities that were far above the others and far above one hundred percent. Dr. Neels speculated that the difference between his cross-sectional results and all the other results came about because his cross-

[46] Tr. 28/15785.

sectional results were "long-run."[47] We now see that the difference comes not because of that reason but rather because of specification bias. Dr. Neels agreed that a large variation in results between models could arise because of a mis-specification of one the models:

> If you are changing the specification of the model one often finds big changes in results. I mean that is known as specification bias, so I guess I wouldn't be surprised to see big changes in results when one changes the specification in ways that matter.[48]

His cross-sectional models suffer from exactly this type of bias. The capital variables in my cross-sectional models are statistically significant because they are embodying the important facility-specific effects. The fact that they are statistically significant signifies that omitting them from the cross-sectional equation causes an omitted-variables bias. That bias causes the cross-sectional variabilities to be artificial forced upward and to be well above one hundred percent.

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[47] Tr. 28/15801.

[48] Tr. 28/15807.