

Report to Accompany the Postal Service's Reply Comments in Docket No. RM2016-12

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## **I. Introduction**

On October 17, 2016, United Parcel Service filed the Report of Dr. Kevin Neels and Dr. Nicholas Powers to Accompany UPS Comments in Docket No. RM2016-12 (hereinafter the Brattle Group Report) as the basis for its reply comments in this docket. In addition, the Public Representative submitted a set of comments. Subsequent to those filings, the Postal Service requested a review of both submissions to evaluate their arguments, assertions, criticisms, and suggestions. This report presents the results of that review.

## **II. The Brattle Group Report Asserts That Transportation Cost System (TRACS) Data Are So Imprecise That They Cannot Be Used To Estimate A Capacity To Volume Variability. This Assertion Is Based Upon Both Conceptual Misconceptions And Faulty “Tests” Of Accuracy Of TRACS Data.**

### **A. Conceptual Misconceptions**

TRACS highway data have been successfully and appropriately used by the Commission and the Postal Service to analyze transportation costs, in a variety of contexts, for over twenty-five years. TRACS is an ongoing statistical system that plays a vital role in the annual ACR filing made by the Postal Service.<sup>1</sup> Yet, one of the primary criticisms of Proposal Four by the Brattle Group Report is that the TRACS data are so imprecise and error-ridden that they cannot be used for estimating capacity to

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<sup>1</sup> TRACS data were first accepted by the Commission in Docket No. R90-1. For further discussion about the scrutiny and improvements in cost attribution that resulted from TRACS, please refer to the Docket No. R90-1, Opinion and Recommended Decision, Volume 1 at III-156. In the FY 2015 ACR, TRACS data were used for ACR folders 15, 16, 32, and NP2

volume variabilities.<sup>2</sup> When first accepting TRACS for distributing relevant highway costs to products in Docket R90-1, the Commission 1) indicated that TRACS marked a significant improvement over the previous methodology, 2) subjected TRACS to intense scrutiny before accepting it for regulatory purposes, and 3) had the unanimous support of the mailing community, including UPS, in favor of using TRACS, instead of RPW data, to distribute relevant transportation costs to products.<sup>3 4</sup>

The Postal Service has established a new data collection system, TRACS, to provide the information necessary for an accurate distribution of the costs of those transportation services included in it to the proper subclasses of mail. TRACS is a statistical sampling system which develops distribution keys (on a cubic-foot-mile basis) for highway and freight rail costs. Tr. 5/1155.

The parties are unanimous in their support for the use of TRACS for the transportation services included in it. Even parties whose transportation costs have increased greatly following the initiation of TRACS favor the use of its distribution keys. MPA Brief at 30. United Parcel Service (UPS), a competitor of the Postal Service, calls the system a major improvement. UPS Brief at 37. The parties, and the Commission, subjected the Postal Service's presentation describing TRACS to intensive scrutiny before approving it. It is clear that much careful analytical work has gone into its development, and the record shows that TRACS data reliably reflect the relative use of the three major purchased transportation services.

The Brattle Group Report criticism in the current case is based upon both conceptual misconceptions and faulty “tests” of the accuracy of TRACS data.

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<sup>2</sup> Brattle Group Report at 27.

<sup>3</sup> See, Postal Rate Commission, Opinion and Recommended Decision, Docket No. R90-1, Volume 1 at III-157, para 3641.

<sup>4</sup> Id. at II-155, para 3636.

Correcting the misconceptions and applying standard, and relevant, tests of the TRACS data, however, provides a very different picture. Those tests reveal the TRACS data to be sufficient in both quality and quantity to support estimation of capacity-to-volume variability equations.

One of the Brattle Group Report's apparent concerns is with the size of TRACS samples and the resulting sampling variation.<sup>5</sup> However, in its discussion of this issue, the Brattle Group Report confounds the concept of sampling variation with the concept of measurement error. Sampling variation refers to the fact that multiple samples from a given population will not be equal to one another, even though the individual observations are measured accurately. Sampling error is the difference between the sample estimates and the population values, but the sample value could be above or below the population value. Sampling variation does not cause bias. In contrast, measurement error arises when the variables being collected are measured inaccurately and can occur regardless of the size of the sample. Measurement error can lead to bias.

These two concepts have different implications for regression equations. Contrary to the Brattle Group Report claim, large sampling variation, by itself, does not bias the estimated regression coefficients, but rather causes them to be estimated imprecisely. If the dependent and independent variables in a regression are purely random variables -- called statistical "noise" in the Brattle Group report -- then a regression equation will not be able to estimate a statistically significant relationship between them. Such a condition would be illustrated, for example, by an  $R^2$  statistic and

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<sup>5</sup> Brattle Group Report at 9-10.

an F statistic near zero. But none of the estimated capacity-to-volume equations submitted in support of Proposal Four exhibit this pattern of statistics, indicating that the Brattle Group's concern about statistical variation is only theoretical.

In contrast, measurement error in the independent variable could cause bias and is often associated with what is known as "attenuation" bias, meaning the estimated coefficients associated with the mis-measured variable are under-estimated. In the context of the capacity-to-volume variability equations, attenuation would imply the estimated variabilities are understated. But the correct way to deal with measurement error is to test for the existence of significant error and use an estimation technique that accounts for possible measurement error. That type of estimation is presented later in this report, and both the estimated variabilities and the statistical tests indicate that measurement error is not a disqualifying concern as suggested by the Brattle Group Report.

#### **B. Faulty "Tests" of the Accuracy of TRACS data.**

In addition to the theoretical argument about sampling variation, the Brattle Group Report presents a series of what it labels as "tests" of the accuracy of TRACS data. In reality, the proffered computations are not actually tests, but rather a series of comparisons between TRACS data and other constructed measures accompanied by assertions relating to the nature of the TRACS data. These comparisons contain both conceptual and computational errors. When the errors are corrected, a very different picture of the suitability of TRACS data emerges.

The first "test" put forward by the Brattle Group Report is a just comparison of quarterly TRACS volumes with what the Brattle Group Report terms a "weighted" RPW

volume measure.<sup>6</sup> Before describing the outright errors in the Brattle Group Report's computations, it is important to recognize that there is no *a priori* reason for variations in a quarterly TRACS volume measure to mimic the variation in a quarterly RPW volume measure. The two systems measure very different things. RPW measures originating mail and estimates piece volumes. TRACS, in contrast, measures the cubic feet of mail transported on highway transportation. The two measures should, and do, deviate from one another because of quarterly variations in factors like the cubic profile of mail and the proportion of originating mail transported on the various parts of the purchased highway network.

For example, suppose originating RPW volume experienced rising volumes for a product that was becoming increasingly drop-shipped, such as, for example, DDU-entered Parcel Select. Such an outcome would lead to an increase in RPW volume that was not matched by a similar increase in TRACS volumes. In fact, the TRACS system was constructed because it was recognized that RPW volumes do not provide good measures of the volumes transported on the Postal Service's highway network. The Commission has noted that TRACS provided a significant improvement over the use of national mail volumes (RPW).<sup>7</sup>

The improvement made by TRACS can be seen most clearly by comparing the method formerly used to distribute transportation costs. In previous cases, the Postal Service and the Commission have distributed purchased transportation costs on the basis of national statistics (volume and relevant mail characteristics), and assumptions with regard to the transportation services used by the various subclasses.

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<sup>6</sup> Brattle Group Report at 11.

<sup>7</sup> See, Postal Rate Commission, Docket No. R90-1, Opinion and Recommended Decision at III-156, para 3638

Given these inherent differences, it is essential that any proposed comparison provide a persuasive basis for using quarterly RPW volumes as the measuring stick for evaluating quarterly movements in TRACS. But the Brattle Group Report fails to put forth any justification for why its constructed RPW measure should be used as a standard for assessing TRACS volume.

Moreover, contrary to the Brattle Group's assertion, successful variability estimation does not require TRACS volumes and capacity figures to be estimates of total national highway volume and capacity. In the city carrier street time study approved by the Commission, the sum of the street hours and volumes for the 290 ZIP Codes included in the study were not an estimate of the national street hours and volumes for the over 10,000 ZIP Codes that have city carrier delivery. Nevertheless, the data set was appropriate for variability estimation because it contained the information required to capture the relationship between volume and street time. In the current analysis, the TRACS capacity and volume data embody the capacity and volume information required to provide reliable estimates of the capacity-to-volume variability.

Apart from its conceptual flaws, the RPW and TRACS comparison proposed by the Brattle Group Report contains serious computational errors. First, contrary to the claim in the report, the computed Brattle Group RPW values are not volume measures. They are actually cost measures, which undermines the legitimacy of their comparison with TRACS volumes. This fact can be demonstrated in two ways. The first

demonstration comes from considering the units included in the computational formula provided in the Brattle Group Report. The provided formula is:<sup>8</sup>

$$WV_{qt} = \frac{\text{Regular Costs}_{qt}}{\text{Total Costs}_{qt}} \sum_{c=1}^C P_{Cq} w_q.$$

Now consider the units for each of the magnitudes in the formula. Both Regular Costs and Total Costs are in dollars, P is a volume piece count and the weight, w, is a ratio of dollars to piece counts. Substituting the units into the formula and cancelling like units demonstrates that the weighted “volume” measure is actually a dollar measure:

$$WV_{qt} \text{ Units} = \frac{\text{Dollars}}{\text{Dollars}} \sum_{c=1}^C \text{Pieces} \frac{\text{Dollars}}{\text{Pieces}} = \text{Dollars}.$$

The fact that the Brattle Group Report proposed “weighted volume” measure is actually a cost measure can also be demonstrated by implementing the calculation. For example consider the calculation of Inter-NDC RPW weighted “volume” for Bound Printed Matter Flats. Applying the Brattle Group Report formula requires multiplying each quarterly RPW piece volume (P) by the Bound Printed Matter Flats weight (w) of \$0.01268 per piece. This calculation is implemented for FY 2014 and FY 2015 in Table 1.

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<sup>8</sup> Brattle Group Report at 12.

Table 1

Calculating the Brattle Group Weighted "Volume"  
for Bound Printed Matter Flats for Inter-NDC  
Transportation

Fiscal Year	Postal Quarter	RPW Volume (000)	Weighted "Volume" (\$000)
2014	1	72,360	\$917.72
2014	2	60,958	\$773.10
2014	3	54,765	\$694.56
2014	4	61,662	\$782.04
2015	1	76,031	\$964.28
2015	2	64,354	\$816.18
2015	3	56,267	\$713.61
2015	4	63,840	\$809.66

Now add the four quarterly "Volume" figures for FY 2015:

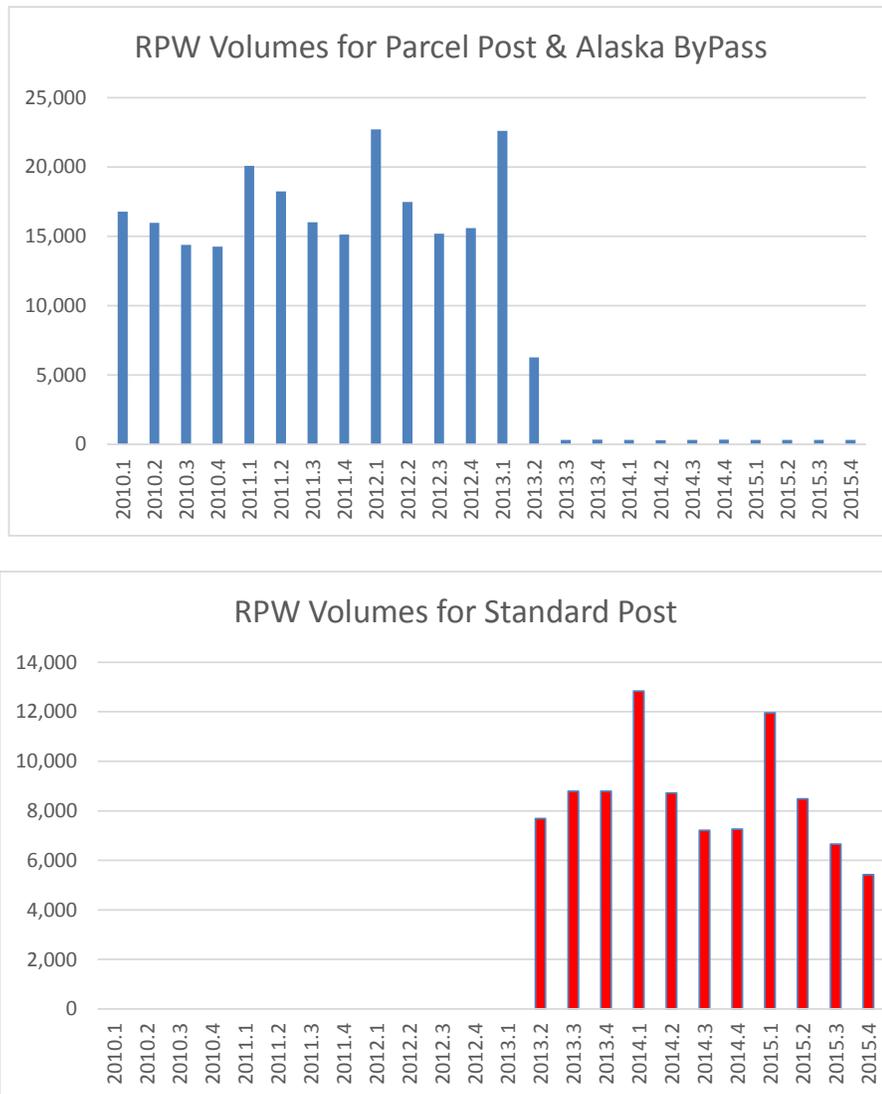
$$\$964.28 + \$816.18 + \$713.61 + \$809.66 = \$3,303.72$$

That sum of \$3,303.72 equals the FY 2015 attributable costs for Bound Printed Matter Flats in Inter-NDC highway transportation. In fact, if the Brattle Group Report had used year-specific weights instead of FY 2015 weights for all years, each product's calculated weighted "volumes" would have been approximately equal to the product's attributable purchased highway transportation costs by account category.

In addition to calculating a cost measure instead of the intended volume measure, the Brattle Group Report calculation also includes a serious computational mistake. The Brattle Group Report calculation did not account for the restructuring of the Postal Service's package services products that caused volume to shift from "Parcel Post" to "Standard Post." Over ninety-five percent of the volumes that were recorded as

“Parcel Post” through the first postal quarter of FY2013, were subsequently recorded as “Standard Post”.<sup>9</sup> As a result, Parcel Post volume went to zero in FY 2013, at the same time Standard Post volume started to be recorded.

Figure 1: RPW Volumes (000) for Parcel Post and Standard Post

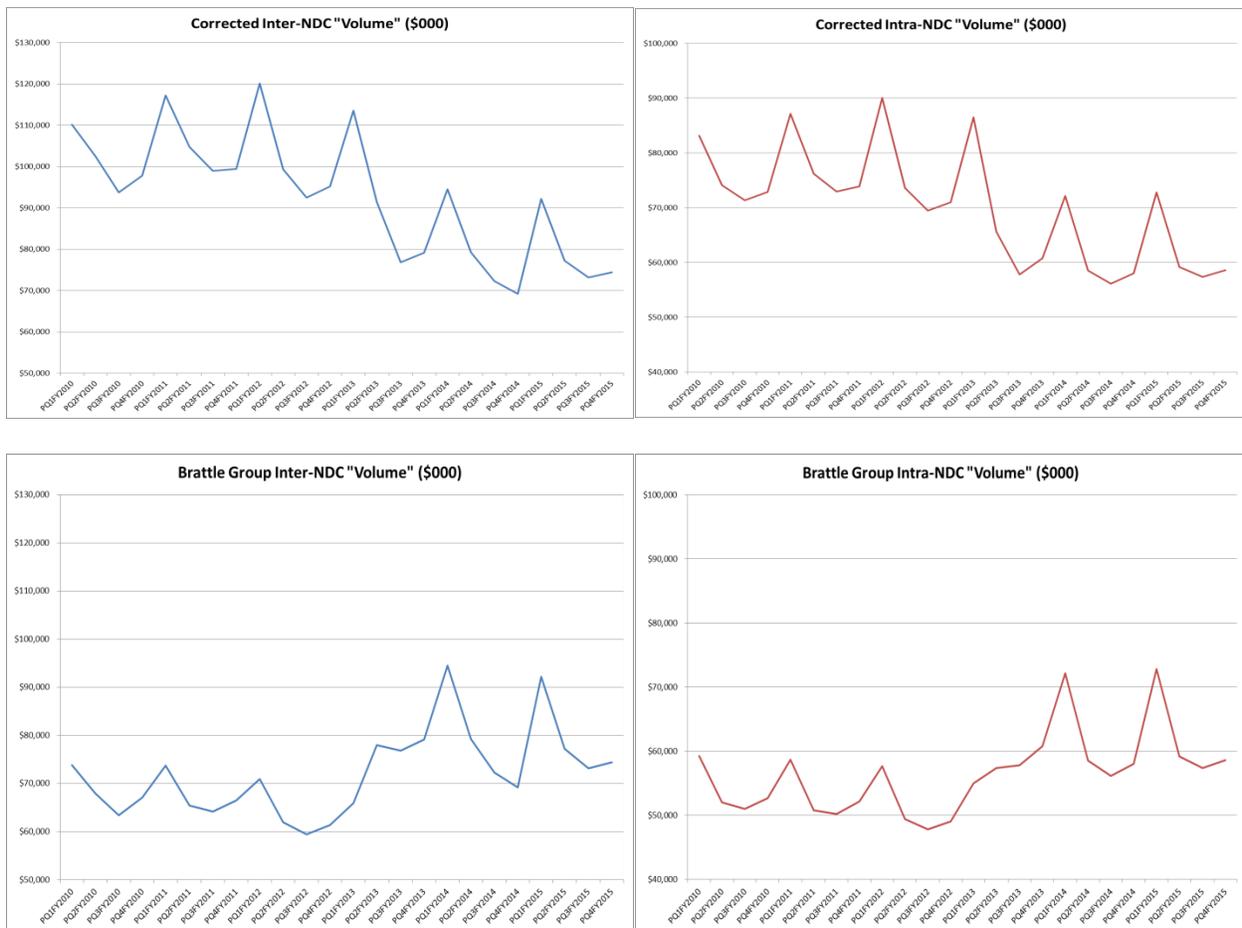


Source: USPS-RM2016-12/3

<sup>9</sup> Parcel Post volumes included Alaska Bypass amounts until Alaska Bypass became a separate product on January 27, 2013.

Because the Brattle Group Report applied FY 2015 weights to RPW volumes for all years, it applied a zero weight for Parcel Post volumes for all years. This means that it omitted Parcel Post volumes from its weighted “volume” calculations for the years FY 2010 through FY 2013. This is a material omission and causes a substantial understatement of weighted “volume” for the early years of the sample, particularly for the two NDC account categories. This omission causes the Brattle Group Report to infer that both inter-NDC and intra-NDC “volume” increased when, in fact, they actually decreased.

Figure 2: Battle Group and Corrected RPW Weighted “Volume” Measures



Source: USPS-RM2016-12/NP2

**C. The Brattle Group Report misuses the TRACS cost variable to draw invalid inferences about the quality of the TRACS data.**

The Brattle Group Report also claims to “test” the TRACS data by first constructing a set of TRACS-based cost estimates and comparing them with attributable costs.<sup>10</sup> Apparently, the Brattle Group took the “COST” variable that appears in the public TRACS folder (USPS-FY15-36) and multiplied it by the respective strata weights from TRACS and summed across all tests within a postal quarter and contract type. The resulting sum was mistakenly asserted to be a population estimate of a contract type’s quarterly accrued regular cost. The Brattle Group Report then compared their calculated costs to the accrued costs from the general ledger. But the Brattle Group Report did not provide any justification for why the “COST” variable in TRACS was appropriate for its proposed calculation. In fact, the Postal Service warned the Commission that the TRACS “COST” variable was not reliable and should not be used for estimating costs:<sup>11</sup>

Also, the estimated leg cost reflects the overall annual contract cost and does not relate directly to the volumes being carried on that leg. Thus, those costs may be caused by other routes or capacities besides the one being tested in TRACS.

The caution is justified because the “COST” variable in TRACS is not used, it is not maintained, and its accuracy is not verified. It is not surprising, and is perhaps even

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<sup>10</sup> Brattle Group Report at 20.

<sup>11</sup> See, Response of the United States Postal Service to Chairman’s Information Request No. 2, Q.8 (September 30, 2016). In its filing, the Postal Service purposely did not include the “COST” variable as it was not needed for its analysis. The “COST” variable is included with the ACR filing of TRACS data, but it is not used in the calculation of distribution factors.

likely, that using this inaccurate variable could lead to either overestimates or underestimates of accrued costs.

Although the Brattle Group cost estimates have no utility for directly comparing TRACS volume data with accrued cost data, they can be used to test one of the main assertions of the Brattle Group Report. Recall that the Report claims that there is a large amount of statistical noise in the TRACS data, and that noise leads to a downward bias in the estimated variabilities.<sup>12</sup> In other words, according to the Brattle Group Report, when there is a lot of statistical noise, the estimated variabilities should be low, but when there is relatively little noise, the estimated variabilities should be closer to one.

The Brattle Group Report argues that its cost comparisons show “that something in the way the COST variable from the TRACS data was recorded in FY13, such that, for most contract types, the accuracy of the COST measure improves beginning in that year.”<sup>13</sup> This suggests a testable implication of the Brattle Group assertion that statistical noise is imparting a downward bias to the estimated variabilities. If the accuracy of the TRACS data improved in the FY 2013 to FY 2015 period relative to its accuracy in the FY 2010 to FY 2012, for most contract types, then variabilities estimated on the FY 2013 to FY 2015 data should be appreciable larger than the variabilities estimated on the FY 2010 to FY 2012 data, for most contract types. This implication can be tested by estimating separate variability equations for the two sub-periods and then comparing them.

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<sup>12</sup> Brattle Group Report at 24.

<sup>13</sup> Brattle Group Report at 21.

Table 2 shows that this test rejects the Brattle Group assertion about the effect of statistical noise on the estimated variabilities. For three of the four account categories, the estimated variabilities are lower in the later period, directly contradicting the assertions that statistical noise in the earlier period is biasing the variabilities downward.

Table 2  
Estimated Moving Capacity Variabilities from the Translog Model  
and Dropping Zero Volume Tests

Category	FY2010-FY2012	FY2013-FY2015
Intra-SCF	76.5%	75.8%
Inter-SCF	70.1%	89.3%
Intra-NDC	80.8%	75.2%
Inter-NDC	86.5%	80.1%

Source: USPS-RM2016-12/3

In another attempt to question the use of TRACS data, the Brattle Group Report focuses on an extremely small number of year-over-year changes, for isolated days of the week, in which the capacity changes appear to be not consonant with the volume changes.<sup>14</sup> The report claims that these few observations invalidate all of the TRACS data in order to “prove” that the relationship between capacity and volume through time is not reliable in TRACS. If so, the Brattle Group Report argues, then TRACS data should not be used to estimate a capacity-to-volume variability. This “test” is actually just a search for a few unusual observations, and is misleading as an evaluation of the

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<sup>14</sup> Brattle Group Report at 23.

overall pattern of volume and capacity movements. Actual analysis of the year-over-year movements in capacity and volume shows them to be highly correlated. This result holds whether one looks at day-of-week data, weekly data or even quarterly data. Table 3 presents the correlation in year-over-year changes in TRACS’s capacity and volume measures by account category. It shows, contrary to the Brattle Group Report assertion, that the two measures are highly correlated.

Table 3  
Correlations of Year over Year Changes in TRACS DOW Capacity and Volume Measures

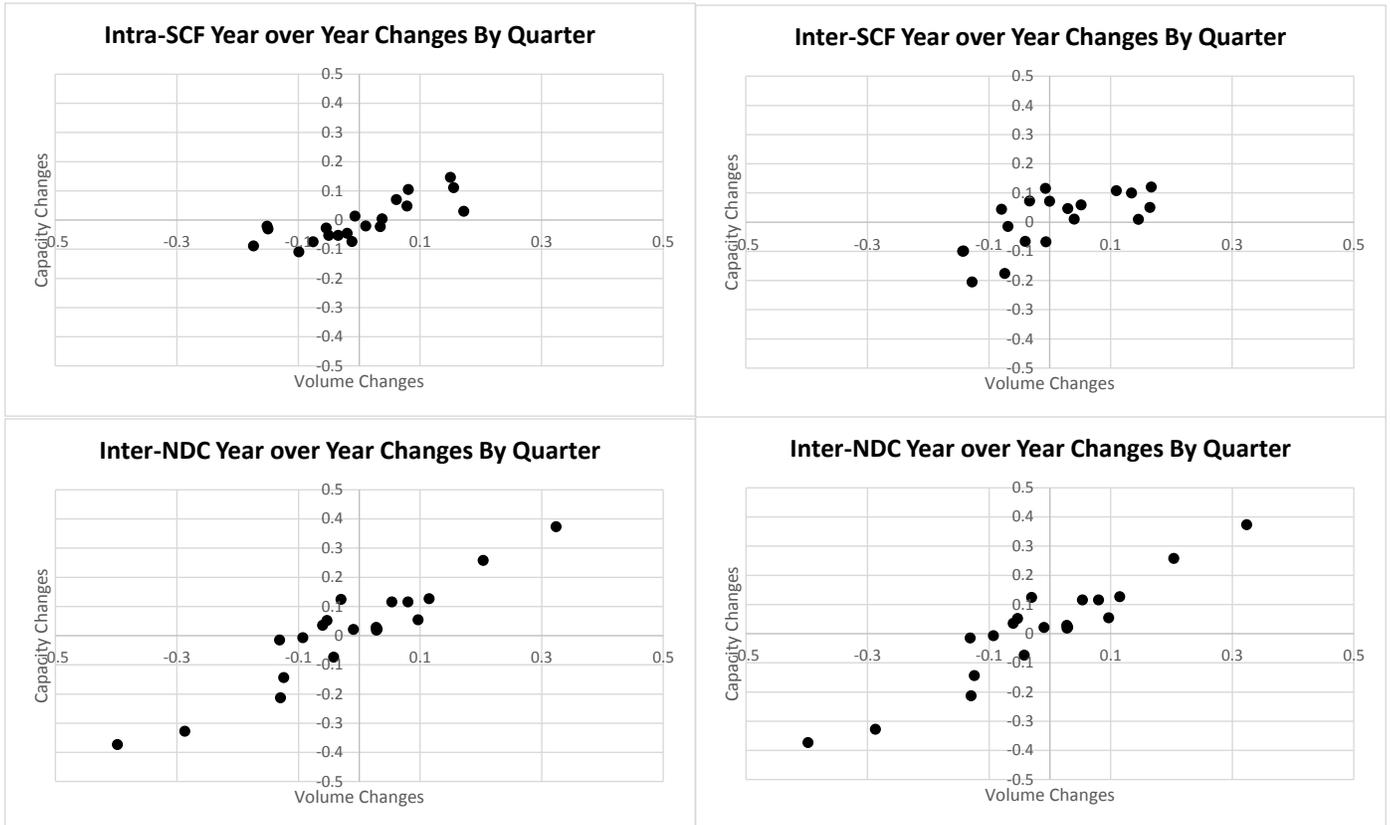
Category	Correlation	p-Value
Intra-SCF	79.6%	0.0001
Inter-SCF	74.0%	0.0001
Intra-NDC	81.3%	0.0001
Inter-NDC	88.0%	0.0001

Source: USPS-RM2016-12/3

Graphically, Figure 3 illustrates a remarkably stable relationship in year-over-year variations between capacities and volume. Each of the following graphs in the figure show the year-over-year changes in TRACS capacity and TRACS volumes, by quarter, for a different account category. Observations in the northeast and southwest quadrants mean the volume and capacity moved in the same direction, whereas observations in the northwest and southeast quadrants mean that volume and capacity moved in opposite directions. Nearly all of the observations are in the northeast and southwest quadrants, implying concordance between capacity and volume movements. The few observations that are in the northwest category are close to the origin, meaning

they represent small increases in capacity associated with small volume declines, which is completely feasible.

Figure 3: Year over Year Changes in Capacity and Volume By Account Category



Source: USPS-RM2016-12/3

Whether there is a statistically reliable relationship between capacity and volume on a year-over-year basis can be directly tested by estimating the capacity-to-volume variability equations on the year-over-year changes in capacity and volume. The Brattle Group Report argues that there is so much noise in the year-over-year changes in capacity relative to the year-over-year changes in volume that it is not possible to

estimate a statistically reliable equation containing the two variables.<sup>15</sup> But the Brattle Group Report does not make the logical next step and estimate the variability equations on year-over-year data. If the Brattle Group assertion is correct, such equations will have extremely low R<sup>2</sup> statistics and insignificant estimated coefficients on the volume terms.

Table 4 presents those key statistics from regressions on year-over-year, day of week data, by account category. In all instances, the t-statistic on the volume coefficient is very large and, given that these are equations on differences, the R<sup>2</sup> statistics are quite high. These results strongly reject the assertion that there is so much noise in year-over-year changes in the TRACS data that they should not be used to estimate variability equations.

Table 4

Statistics From Double Log Variability Equations Based on Year-over-Year Changes By Quarterly Days of Week FY 2010-FY 2015

Category	Volume Coefficient t-statistic	Equation R <sup>2</sup>
Intra-SCF	15.43	63.3%
Inter-SCF	12.93	54.8%
Intra-NDC	16.39	66.1%
Inter-NDC	21.72	77.4%

Source: USPS-RM2016-12/3

Estimation of the capacity-to-volume variability equations on year-over-year data also provides another example of the robustness of those equations and produces more

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<sup>15</sup> Brattle Group Report at 24.

evidence indicating that the currently assumed variability of 100 percent is not supported by the data. Table 5 presents the estimated variabilities from estimating the capacity-to-volume variability equations both on the levels of quarterly, day of week, and on the year-over-year changes in those variables.

Table 5

Capacity to Volume Variabilities Based on Quarterly Day of Week Data, FY 2010-FY 2015

Category	Double Log	Translog
Intra-SCF	48.0%	60.6%
Inter-SCF	68.8%	69.9%
Intra-NDC	57.4%	61.3%
Inter-NDC	75.7%	73.6%

Capacity to Volume Variabilities Based on Year over Year Changes in Quarterly Day of Week Data, FY 2010-FY 2015

Category	Double Log	Translog
Intra-SCF	44.7%	47.9%
Inter-SCF	57.7%	64.6%
Intra-NDC	69.4%	70.3%
Inter-NDC	80.2%	83.8%

Source: USPS-RM2016-12/3

In no instance are the estimated variabilities close to one hundred percent and the general pattern of estimated variabilities is the same in both cases. The Intra-SCF variability is generally lowest and the Inter-NDC variability is generally the highest. These results are yet additional evidence that the Brattle Group Report's concerns about the usefulness of TRACS data are overstated.

## **II. The Brattle Group Report Erroneously Asserts That The Postal Service's Variability Equations Are Mis-specified And Fail To Capture The "True" Determinants Of Highway Capacity. This Assertion Is Based Upon Several Misconceptions About The Postal Service's Variability Equation.**

The Brattle Group Report makes a number of relatively strong statements which are intended to question the specification of the variability equations underlying Proposal Four. However, the support for these statements is not actual evidence, but just argumentation. The presented support for the statements amounts to a listing of unsupported, and generally erroneous, statements. The assertions are speculative and not based upon any research, or experience, with how the Postal Service actually determines its highway capacity.

For example, the Brattle Group Report asserts that the correct unit of analysis for a variability analysis is necessarily a route, and the Postal Service's model specification fails because it collects data at the individual stop.<sup>16</sup> This assertion is wrong in several respects. First, it is not obvious that if one chose to pursue a cross-sectional analysis of the capacity-to-volume variability, that one would necessarily select a route as the correct unit of analysis as the Brattle Group Report claims. But more importantly, the Brattle Group Report's assertion is without merit because it fails to recognize that the Proposal Four variability equations are estimated with time-series data, not cross-sectional data. While the TRACS data are indeed collected at the stop, the econometric analysis is not done at the individual stop. Rather, the unit of analysis for the econometric analysis is a unit of time -- day of week, a week of the year or, as in this report, the quarter of the year.

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<sup>16</sup> Brattle Group Report at 27.

The Brattle Group Report also fails to recognize that in an econometric analysis, there is no requirement that the unit of analysis be at the same level as the level at which data are collected. In the recent city carrier street time study, for example, the parcel data were collected by the individual stop but the unit of analysis was the ZIP Code.<sup>17</sup> The variability equations used in Proposal Four were specified to measure how purchased highway transportation capacity responded to changes in highway volume that took place over the six-year period from FY 2010 through FY 2015. The econometric results demonstrate that the equations do a good job of measuring that response, and are properly specified to produce the required variabilities. The Brattle Group Report's assertion on the unit of observation is, essentially, irrelevant because it does not relate to the manner in which the equations are estimated.

Another key assertion made by the Brattle Group, without any evidence or documentation, is that the Postal Service determines its purchased transportation network capacity solely based upon what the Report calls "peak" volume.<sup>18</sup> This assertion is factually incorrect. While the Postal Service does consider its volume on its peak days when setting capacity, it also looks at other factors such as service standards, mail processing schedules, and the need to balance volume flows throughout its network. A primary consideration is that the Postal Service must plan to transport the mail in a way which facilitates making its service standards even if that results in unused capacity.<sup>19</sup> In addition, the Postal Service has more flexibility in

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<sup>17</sup> USPS-RM2015-7/1, City Carrier Street Time Study Report.

<sup>18</sup> Brattle Group Report at 28.

<sup>19</sup> See United States Postal Service, Response to Chairman's Information Request No. 3, Question 3, October 5, 2016.

setting its capacity than the Brattle Group Report suggests. As an example, consider that Monday mornings and days after holidays are generally heavy volume days for transporting mail to delivery units. If volume were to consistently exceed the existing capacity on those days, additional transportation, just for those days, could be scheduled to support timely movement of volume to the delivery units. The scheduled annual frequency of these trips would operate just Mondays and days after holidays, as there is no need to add trips on the other days of the week.

In addition, it can often be the case that utilization on even the heaviest day may be well below 100 percent. The unused capacity arises from the need to make service standards and meet mail processing schedules, and is also reflected by the fact that trucks in the Postal Service purchased transportation network are rarely full. By UPS's own calculation, trucks in the Intra-SCF category are full only 6 percent of the time, reflecting service requirements.<sup>20</sup>

In a related assertion, the Brattle Group Report falsely claims that the Postal Service's variability analysis "implausibly" assumes that there is daily adjustment of capacity to volume.<sup>21</sup> Apparently, this assertion is based upon the fact that a number of the variability equations supporting Proposal Four follow the Commission's original specification of organizing the quarterly data by day of week.<sup>22</sup> Note this approach

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<sup>20</sup> Brattle Group Report at 25.

<sup>21</sup> Brattle Group Report at 28.

<sup>22</sup> In its Docket No. N2010-1 analysis, the Commission introduced a variable called "TRIPS" as a measure of highway frequency. The Brattle Group Report correctly points out in Footnote 21, page 9, that the interpretation of the Commission's variable provided in the original Bradley Report is inconsistent with the construction of the variable. Further review of the Commission documentation provides a better interpretation. In

involves aggregating the volumes and capacities for all, say, Tuesdays in the quarter. It thus includes measures of quarterly, not daily, variations in volume and capacity.

The falsity of this Brattle Group Report assertion can be readily demonstrated. The report claims that aggregating the data by day of week will bias downward the estimated variabilities of capacity with respect to volume.<sup>23</sup> This assertion can be straightforwardly tested. Rather than aggregating the quarterly data by day of week, so there are seven observations per quarter, one can aggregate the quarterly data across all days of the week, so there is just one observation per quarter. Under this aggregation, it is without question that there is no assumption of daily adjustment of capacity to volume. If the Brattle Group assertion is correct, estimation of capacity-to-volume equations on quarterly data should produce variabilities close or equal to one hundred percent. But such an outcome does not occur. As Table 6 shows, the quarterly variabilities are in the same range as the day of week variabilities, with some

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fact, the TRIPS variable is a measure of the quarterly frequency of “leg-trips” across the highway transportation network, for the type of transportation provided in the TRACS test. This is an appropriate variable because the Commission’s analysis is done at the quarterly frequency, by day of week. By regressing a measure of the total number of trips for each day of week in the quarter on a measure of transported volume for the same day of week in that quarter, the Commission’s analysis can estimate the response in total trips, across the type of transportation being analyzed, to changes in volume in that type of transportation. The Postal Service’s model underlying Proposal Four includes capacity as the dependent variable in the regression and the misinterpretation of the TRIPS variable has no effect on that estimation.

<sup>23</sup> Brattle Group Report at 31.

above and some below. Such variation is expected as the quarterly variabilities come from equations with just 24 observations.<sup>24</sup>

Table 6  
Capacity to Volume Variabilities Based on Quarterly  
Observations FY 2010-FY 2015

Category	Double Log	Translog
Intra-SCF	39.9%	41.1%
Inter-SCF	70.0%	70.0%
Intra-NDC	58.6%	42.3%
Inter-NDC	77.9%	65.6%

Source: USPS-RM2016-12/3

The Brattle Group Report also asserts the Postal Service’s volume-to-capacity variability models “fail to consider economic factors” because they imply “irrational” behavior on the part of the Postal Service. In reality, this assertion is nothing other than a classic “straw man” fallacy. The Brattle Group Report claims that a variability of less than 100 percent, under current operational conditions, implies that eventually, the Postal Service will reach full capacity and could no longer accommodate mail volume growth. This occurs because capacity is growing as a slower rate than volume. But this assertion implicitly relies upon the same false assumption used by Dr. Neels in Docket No. RM2016-2: the assumption of a constant variability away from the region of estimation. There is nothing about the Postal Service’s approach that requires the currently-estimated variabilities to remain the same if volume would somehow grow so much that it filled all available unused capacity. If the Postal Service purchased

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<sup>24</sup> The original Bradley Report also estimated variability equations on weekly data, another way of avoiding the Brattle Group’s claimed day-of-week bias. Those results also rejected the bias claim.

highway transportation network averaged 90 percent capacity utilization rather than 40 percent capacity utilization, it is quite likely the capacity-to-volume variabilities would be higher.<sup>25</sup> The assumption that the current variabilities would be maintained as the Postal Service's network approached complete capacity utilization is made by the Brattle Group Report, not by the Postal Service models.

Similarly, the Brattle Group Report argues that variabilities less than 100 percent imply that the Postal Service will allow capacity utilization to "fall without limit."<sup>26</sup> Of course, this is essentially the same unfounded assertion, as a variability of 80 percent at current volume levels implies no such thing. Rather, such a variability suggests that the Postal Service simply does not reduce capacity lockstep with volume declines, because factors other than peak volume determine capacity needs. The need to make certain trips for service reasons, for example, could easily cause capacity to decline less quickly than volume. The need to move mail between two facilities on a daily basis will require the Postal Service to continue make a daily trip between those facilities even in the face of a volume decline.

Of course, the Postal Service can, and does, rationalize its network as volume declines. This is reflected in the estimated capacity-to-volume variabilities of around 80 percent. Contrary to the Brattle Group Report's false assertions, variabilities of this size do not mean the Postal Service fails to reduce its capacity in response to persistent volume declines.

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<sup>25</sup> The empirical evidence supports this point. As expected, estimating the variability equations solely on TRACS tests with very high capacity utilization lead to higher variability estimates. A complete discussion of this result is included in the next section.

<sup>26</sup> Brattle Group Report at 32.

#### **IV. The Brattle Group Report Asserts That The Postal Service's Variability Estimates Are Biased Downward Because Of Mis-specification Errors And Data Noise, But Fails To Test For Bias. Testing Of The Assertion Reveals The Alleged Bias Is Not A Problem.**

The Brattle Group Report makes the argument that the estimated variabilities are biased downward because of sampling variation or noise in the TRACS data.<sup>27</sup> We demonstrated above why there is no mis-specification in the Postal Service's variability equations, and the Brattle Group Report adds little new here. In fact, its proposed "thought experiment" serves to illustrate its confusion between sampling variation and measurement error. The "thought" experiment envisions just two observations from a network that never changes capacity, but records two different volume measures. As explained above, in such a scenario, there would be no relationship between capacity and volume, and a capacity variability equation would have an  $R^2$  of virtually zero. That is not the situation for any the Postal Service's variability equations, rejecting the relevance of the proposed thought experiment. In addition, the TRACS data do not rely upon just two observations from the same route, but many observations from many routes and, as also demonstrated above, give a reliable estimate of the patterns of capacity and volume through time. The value of many observations was discussed by the Public Representative:<sup>28</sup>

While these extrapolations could be problematic for the representativeness of the TRACS data, the large number of observations mitigates that concern. Through the Central Limit Theorem, the large number of samples across all the different trucks will create a normal distribution of volumes and capacities, allowing for accurate statistical analysis.

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<sup>27</sup> Brattle Group Report at 36.

<sup>28</sup> See, Public Representative Comments, Docket No. RM2016-12 at 12.

In addition, the Brattle Group Report raises the issue measurement error and asserts that the estimated variabilities could be biased. It does not pursue the appropriate tests to see if the bias actually exists. In order perform those tests, one can estimate an instrumental variable regression.<sup>29</sup> Downward bias arises because the measurement error in the independent variable is correlated with the error term in the regression. In an instrumental variable regression, the variable with the measurement error is replaced with an “instrument,” which is another independent variable which, by construction, is not correlated with the error term. The resulting estimator is thus unbiased and consistent. More formally, consider the following regression:

$$Y = X\beta + \varepsilon,$$

In this regression  $Y$  is a  $T \times 1$  vector of observations on the dependent variable,  $X$  is a  $T \times K$  matrix of observations on the  $k$  independent variables, and  $\beta$  is a  $K \times 1$  vector of parameters to be estimated. Because of potential measurement error,  $X$  contains  $K_1$  columns of observations on truly exogenous independent variables which are not correlated with, and  $K_2$  columns of observations on independent variables that are possibly correlated with,  $\varepsilon$ . Now, suppose one finds  $K_3 > K_2$  variables that can serve as instruments for the independent variables measured with error. To construct the instrumental variables estimator first combine  $K_1$  with  $K_3$  to form a new matrix  $Z$ . Then, the instrumental variables estimator uses the  $Z$  matrix in the following way:

$$\beta^{IV} = [(X'Z(Z'Z)^{-1})Z'X]^{-1}X'Z(Z'Z)^{-1}Z'Y.$$

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<sup>29</sup> For a discussion of the instrumental variables estimator, see, Davidson, Russell and Mackinnon, James G., Estimation and Inference in Econometrics, Oxford University Press, New York, 1993 at 215.

To implement this estimator, one forms the matrix  $\hat{X}$ , the predicted X matrix that includes the  $K_1$  columns of observations on truly exogenous independent variables and  $K_2$  columns of observations containing predictions for the independent variables measured with error, from the best linear combination of the possible instruments. This implementation produces a more intuitive form of the instrumental variables estimator:

$$\beta^{IV} = (\hat{X}'\hat{X})^{-1}\hat{X}'Y.$$

An important challenge in forming an instrumental variable estimator is finding useful instruments. It is not sufficient for an instrument to be uncorrelated with the error term in the original equation. To be of value, it must also be correlated with the variable measured with error. Fortunately in the case of the capacity-to-volume variability equations, we have a set of potential instruments readily available for three of the four account categories.<sup>30</sup>

For any of these account categories, like Inter-NDC, we can use the volumes from the other three account categories as instruments. Before estimating the instrumental variables equation to facilitate testing for the possible correlation between volumes and the error term in the original equation, one should check to be sure that the instruments are sufficiently strong. A strong instrument does a sufficiently good job replacing the original variable, while a weak instrument does not. The Stock and Watson standard of instrument strength is whether the F-statistic from the first-stage regression (regressing the included variable on the instruments) is greater than 10. If the test statistic is greater than 10, the standard indicates the presence of strong

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<sup>30</sup> Because of the split nature of the data in the Intra-SCF category, reliable instruments could not be found for Intra-SCF volume.

instruments. As Table 7 shows, the F-statistics greatly exceed the standard and imply rejection of the presence of weak instruments for all three account categories.

Table 7  
F Statistics for Weak  
Instruments

Category	F-Statistics
Inter-SCF	104.47
Intra-NDC	56.72
Inter-NDC	55.83

Source: USPS-RM2016-12/3

Once the instrumental variable equations are estimated, one can test for correlation between the volume variables and the error terms in the original equations. Because this correlation is the source of the bias, this also is a test for the existence of bias. Conceptually, this test is a quadratic form for the difference between the OLS estimator and the instrumental estimator.

$$m = \hat{q}' [V(\hat{q})]^{-1} \hat{q}, \text{ where } \hat{q} = \hat{\beta}^{IV} - \hat{\beta}^{OLS}.$$

However, there are potential computational issues with the test in this form, so an equivalent, but computationally reliable, form of the test is found by estimating the following augmented regression:

$$Y = X\beta + \hat{X}\gamma + \varepsilon,$$

In this augmented regression,  $\hat{X}$  is the predicted values of  $X$  constructed from regressing it on the instruments. Table 8 provides the results of this test and they

clearly reject the Brattle Group Report’s assertion of widespread and massive measurement error. The test rejects the hypothesis of correlation between volume and the error term for both the Intra-NDC and Inter-NDC equations indicating that the original estimates are unbiased and efficient. The test does suggest the possibility of bias for the Inter-SCF equation, so that category bears further investigation.

Table 8

Tests for Correlation Between Volume and the Error Term in the Original Regression Category t-Statistics

Category	t-Statistics
Inter-SCF	3.65
Intra-NDC	1.05
Inter-NDC	1.66

One way to assess the impact of the potential bias is to compare the estimated coefficients from both the original OLS model and the coefficients from the instrumental variables model. In the case of the double-log model, one need only compare the estimated coefficients on the log of volume, because they are the estimated variabilities. As expected, the coefficient from the instrumental variables equation is a bit higher, but the important point is that it, too, is substantially below one hundred percent. That is, there is no evidence that the true variability is actually 100 percent, as the Brattle Group Report assumes. In fact, the instrumental variables estimate is in the same range as the various other estimates of the Inter-SCF capacity-to-variability estimates provided by the Postal Service.

Table 9  
 Estimated Variabilities From a Double Log Model  
 for Inter-SCF Transportation FY 2010-FY 2015

Model	Variability
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OLS	0.688
IV	0.781

Source: USPS-RM2016-12/3

Although the Brattle Group Report fails to directly test for bias, it purports to indirectly demonstrate the alleged bias in the TRACS data by separating what it calls the “chaff” (trucks with less than 100 percent utilization) from what it calls the “wheat” (trucks with 100 percent utilization).<sup>31</sup> In other words, the Brattle Group Report runs a series of regressions in which it sequentially eliminates TRACS tests with low capacity utilization. When the Brattle Group Report does this, not surprisingly, the estimated variability increases and approaches one hundred percent. Unlike the direct test performed above, this indirect exercise reveals no bias. Rather, it simply suggests that if the Postal Service had a different purchased highway transportation network than it actually has, then the estimated variability would be different. In a network with near 100 percent utilization, one would expect the variability to be higher because there is a very close connection between volume changes and capacity changes. In a network with near zero utilization, one would expect a very low variability as volume would change without affecting capacity.

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<sup>31</sup> Brattle Group Report at 32.

The Brattle Group Report also fails to reveal the average utilization in its reconstructed hypothetical network, and the lack of this critical information makes it difficult to properly interpret the presented results.<sup>32</sup> The cutoff level in its proposed high-utilization network is just 50 percent, but the average utilization in the resulting hypothetical network is much higher. Table 10 shows that the average utilizations across account categories resulting from the application of their arbitrary cut-off range from about 80 percent to nearly 90 percent. These resulting average utilizations are much higher than the Postal Service’s true capacity utilization rates embodied in the TRACS data. Thus, the network that the Brattle Group Report is investigating in this hypothetical is very different from the actual USPS network. With virtually all trucks in the network full in the Brattle Group Report’s hypothetical network, it is not surprising that the estimated variability is higher, but that extremely high utilization does not reflect the actual Postal Service purchased transportation network. That the estimated

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<sup>32</sup> Another way to recognize that the proposed exercise does not reflect the Postal Service’s actual network is to observe that when the Brattle Group report eliminates what it calls trucks -- actual TRACS tests – with less than 50 percent utilization, it eliminates over half the “trucks” in the network.

Average Number of TRACS Tests Per Observation

Category	All Trucks	Eliminate Trucks with Less Than 50 Percent Utilization	Reduction in Average Trucks (Tests) Per Observation
Intra-SCF	96.4	27.2	-71.8%
Inter-SCF	92.3	30.8	-66.6%
Intra-NDC	72.8	29.9	-58.9%
Inter-NDC	74.1	39.2	-47.1%

Source: USPS-RM2016-12/3

variability is different for a different network in no way indicates that the estimated variability for the Postal Service’s actual network is biased.<sup>33</sup>

Table 10  
Average Utilization Rates by Account Category

Category	All Trucks	Eliminate Trucks with Less Than 50 Percent Utilization	Eliminate Trucks with Less Than 75 Percent Utilization
Intra-SCF	34.8%	79.4%	91.5%
Inter-SCF	39.2%	82.3%	93.3%
Intra-NDC	45.1%	84.7%	94.0%
Inter-NDC	55.6%	87.6%	95.4%

Source: USPS-RM2016-12/3

In fact, this proposed “test” of bias actually imposes a guaranteed result of a high variability because it is imposing, in the limit, what is essentially a tautology. If all trucks in a network were always 100 percent full, then network capacity and network volume would be the same variable, so a regression of capacity on volume would be just a regression of a variable on itself. This unusual condition necessarily produces a variability coefficient equal to one, implying a 100 percent variability.

Finally, rather than directly testing for bias, the Brattle Group Report constructs and simulates an abstract highway transportation network.<sup>34</sup> The rules governing truck

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<sup>33</sup> In fact, this analysis in the Brattle Group Report directly contradicts its earlier assertion that the Postal Service model fails to consider economic factors (at page 31). There, the Brattle Group Report argues that the Postal Service model implies that if volume grows enough, the Postal Service highway transportation network could not grow enough to accommodate the new volume. As we explained above, that erroneous inference is based upon at Brattle Group assumption that the capacity-to-volume variability does not change as network utilization changes. This analysis by the Brattle Group Report directly contradicts its earlier assumption, and demonstrates the falsity of its argument.

<sup>34</sup> Brattle Group Report at 40.

movements in this artificial network bear little resemblance to how capacity and trips are set in the actual Postal Service network. For example, this stylized network does not account for the Postal Service's need to specify transportation to meet service requirements or mail processing schedules. As an illustration of how unrealistic the simulated network behind the UPS exercise appears to be, at any given sample rate (e.g., 2.5 percent, 1 percent), the average variability estimates for the Intra specification are orders of magnitude larger than the corresponding Inter specification (e.g., 83 percent versus 17 percent, 65 percent versus 8 percent).<sup>35</sup> These results are in conflict with how the Postal Service's highway network actually works, with service constraints playing a larger role in local transportation. Because of service requirements, capacity utilization is low on local transportation, generating ample available capacity for handling additional volume without adding additional capacity.

In addition, the simulation does not incorporate a key aspect of the Postal Service's actual network: the ability to specify additional trips that just run on the heavy days of the week or year. The hypothetical network imposes artificial and erroneous rules to determine capacity, and the resulting simulated "data" do not reflect the true underlying process governing the relationship between volume and capacity in the Postal Service's actual highway transportation network.

Finally, the simulation results do address the issue of bias. As discussed earlier, the Brattle Group Report confuses the effect of sampling variation with the effect of measurement error. The Brattle Group Report analysis of the synthetic data appears to show the point that if a sample size gets too small, then one cannot estimate statistically

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<sup>35</sup> Brattle Group Report at 43-44

reliable equations. But this point does not relate to the data used to estimate the variability equations supporting Proposal Four, as they are reliably estimated. Those equations do not produce the extremely low variabilities generated by the synthetic data, and they exhibit both high t-statistics and high  $R^2$  statistics.

## **V. The Public Representative Accepts The Econometric Model Underlying Proposal Four But Rejects Its Application Based Upon A Series Of Misconceptions About The Interactions Between The Two Variability Models.**

The Public Representative concludes that the Postal Service capacity-to-volume equation “succeeds at estimating the capacity-to-volume variability,”<sup>36</sup> but fails to recommend using the estimated variabilities to calculate attributable costs. The hesitancy to apply the variabilities is based upon concerns about the specification of the “other” variability equation (the cost-to-capacity variability) and concerns about potential issues relating to the compatibility of the two models. As we show below, these expressed concerns reflect misconceptions about how the Postal Service contracting process works, a misunderstanding of how the cost-to-capacity variabilities are estimated, and a misapplication of the concept of endogeneity.

### **A. Proposed Modifications of the Capacity-to-Volume Variability Model**

In his review of the capacity-to-volume model, the Public Representative proposes three relatively minor modifications of the model, including preserving the zero volume observations, changing the specification of the day-of-week variable, and including two sets of categorical variables, one for the postal quarters and one for the

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<sup>36</sup> See, Public Representative Comments, Docket No. RM2016-12 at 13.

fiscal years.<sup>37</sup> As demonstrated in the original Bradley Report, including the zero volume observations noticeably lowers the estimated variabilities but neither of the other proposed modifications has a sizeable impact on the estimated variabilities.<sup>38</sup>

The capacity-to-volume model supporting Proposal Four was estimated both with the zero volume observations included and with them excluded. The Public Representative provides a list of reasonable circumstances that could lead to valid zero volume tests, and recommends applying the model with them included. To the extent these circumstances are valid, the Postal Service agrees that the zero volume observations should be included. The salient point is that in both instances, the estimated variabilities are well below one and lead to rejection of the assumption of proportionality between capacity and volume for all account categories.

The Public Representative prefers an alternative specification of the day-of-week effect and proposes including a series of zero/one dummy variables rather than including different numerical values for each day of the week. The Public Representative also suggests including individual dummy variables for each postal quarter and fiscal year. The motivation for including these additional dummy variables is that there could be forces other than volume movements that cause capacity to vary through time. If so, the impact of these other variables on capacity could be wrongly ascribed to volume, causing the estimated variabilities to be overstated. However, the Public Representative has not presented any suggestions or explanations of what these other capacity-driving forces might be, and has not explained why they vary on a

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<sup>37</sup> Id., at 10.

<sup>38</sup> The effects of the individual changes are presented in a document entitled, "Intermediate Specification Analysis," in PR Library Reference PR-LR-RM2016-12/1.

quarter-to-quarter or year-to-year basis. Moreover, there is no clear pattern of results from the Public Representative's estimated dummy variable coefficients that provide additional insights into variations in capacity.

### **B. Evaluation of The Public Representative's Reasons for Not Applying the Capacity-to-Volume Variabilities.**

Despite generally accepting the Postal Service's capacity-to-volume equations, the Public Representative is hesitant to recommend application of the variabilities they produce. Interestingly, this hesitancy has nothing to do with the variabilities themselves or their underlying model, but rather with issues associated with the "other" (cost-to-capacity) variability and possible interactions between the two models.

The Public Representative's first concern is that there are "structure" differences between the TCSS data were used to estimate the cost-to-capacity variabilities and the TRACS data used to estimate the capacity-to-volume variabilities.<sup>39</sup> The Public Representative is concerned that when the two variabilities are combined, somehow a biased overall variability arises. It is not at all clear how such a bias could occur. The Public Representative provides no explanation of why the multiplication of two individually unbiased variabilities would lead to an overall biased variability. He fails to explain whether the bias in the overall variability would be positive or negative, he fails to provide any source of the alleged bias, he fails to provide a mathematical justification for the existence of a bias, and he fails to indicate the possible magnitude of the alleged bias. The Public Representative also fails to recognize that even before Proposal Four was introduced, in the established methodology, the Commission already combined the

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<sup>39</sup> See, Public Representative Comments, Docket No. RM2016-12 at 17.

results from TCSS data (cost-to-capacity variabilities) and TRACS data (distribution keys). The Public Representative appears to base this concern on a belief that the cost-to-capacity variabilities are estimated at the route level whereas the capacity-to-volume variabilities are estimated at the contract level.<sup>40</sup> To the extent this is the basis for his concern, the concern is unfounded because both sets of variabilities are estimated for the Postal Service's account categories. The cost-to-capacity variabilities are estimated for the following account categories: Intra-P&DC, Intra-District, Inter-P&DC Inter-Cluster, Inter-Area, Intra-NDC and Inter-NDC.<sup>41</sup> It is true that individual variability equations are estimated by truck type, but those variabilities are combined at the account category level before they are applied.<sup>42</sup>

The capacity-to-volume variabilities are also estimated at the account category level, although for SCF transportation, they are at a bit more aggregated level. Prior to FY 2000, SCF transportation was organized into two account categories, Intra-SCF and Inter-SCF. Subsequent to that time, SCF transportation was broken into smaller account categories, with intra-SCF subdivided into Intra-P&DC and Intra-District, and Inter-SCF subdivided into Inter-P&DC Inter-Cluster, and Inter-Area. At that time, the old Intra-SCF and Inter-SCF accounts were largely replaced. . However, TRACS still

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<sup>40</sup> Id., at 19.

<sup>41</sup> See, Direct Testimony of Michael D. Bradley On Behalf of the United States Postal Service, USPS-T-18, Docket No. R2000-1 at 16 and Report on Updating the Cost-to-Capacity Variabilities for Purchased Highway Transportation, Docket No. RM2014-6 at 11.

<sup>42</sup> See, Direct Testimony of Michael D. Bradley On Behalf of the United States Postal Service, USPS-T-18, Docket No. R2000-1 at 62 and Report on Updating the Cost-to-Capacity Variabilities for Purchased Highway Transportation, Docket No. RM2014-6 at 31.

reflects its original structure and first groups these subsets of contracts back into their original groupings before the sample is selected. Thus, it is completely appropriate to match, for example, the Intra-SCF capacity-to-volume variabilities with the Intra P&DC and Intra-District cost-to-capacity variabilities.

The Public Representative's other concern about combining the two variabilities stems from what he believes are different methods of measuring truck capacity in TCSS and TRACS.<sup>43</sup> This concern is also unfounded because vehicle capacity is measured the same way in both data sets. The Public Representative is incorrect when he states that "TCSS does not appear to directly measure vehicle capacity."<sup>44</sup> TCSS specifies vehicle capacity for each trip on each route, so it has a very direct measure of capacity. The Public Representative is also mistaken about how truck capacity is measured in TRACS. Contrary to the Public Representative's assertion that "vehicle capacity in TRACS is built up from a number of measurements,"<sup>45</sup> vehicle capacity in TRACS is based upon the size of the vehicle. Each size trailer or straight-body truck has a known cubic capacity, and, just as in TCSS, it is that known capacity that is used in TRACS.

The other two Public Representative concerns relate, curiously enough, to neither the capacity-to-volume variability model nor to the interaction between the two models. These concerns relate solely to the cost-to-capacity model and are thus irrelevant for whether or not Proposal Four should be adopted. That is, if correct, these two concerns exist independent of the capacity-to-volume variability. The first concern

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<sup>43</sup> See, Public Representative Comments, Docket No. RM2016-12 at 19.

<sup>44</sup> Id. at 21.

<sup>45</sup> Id.

relates to alleged bias due to endogeneity of the capacity variable in the cost-to-capacity variability equation and the second concern apparently relates to the possibility of omitted variables bias in the same equation.<sup>46</sup>

The first concern arises because the Public Representative believes that because capacity is an endogenous variable in the capacity-to-volume equation, then it must also be an endogenous variable in the cost-to-capacity equation. But this mistaken belief arises from failing to recognize that endogeneity is a model-based characteristic, not a variable-based characteristic. A variable can be endogenous in one model and exogenous in another one. For example, the amount of rain falling in Iowa would be an endogenous variable in a meteorological model for Iowa but would be an exogenous variable in a crop-yield model for Iowa. Similarly, real Gross National Product would be an endogenous variable in an economic growth model, but an exogenous variable in a household consumption model.

The Postal Service constructs its purchased highway transportation network in a two-step, bifurcated, process. First, Postal Service transportation experts assess the need for capacity based upon volume and service needs. Second, once that capacity is determined, contractors determine how much to bid to provide that service. Although capacity is endogenous to the Postal Service transportation experts in the first step, it is clearly exogenous to the contractors making bids in the second step. Contrary to the Public Representative's assertion, capacity is not correlated with the error term in the cost-to capacity equations.

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<sup>46</sup> Id. at 17

The Public Representative also alleges that there are important variables omitted from the cost-to-capacity equations despite the fact that these equations have been reviewed by the Commission and several intervenors in multiple dockets, including Docket Nos. R87-1, R97-1, R2000-1 and most recently, Docket No. RM2014-6. In none of those dockets did the Commission or intervenors find any evidence of omitted variables. The Public Representative does not suggest what the missing variables might be or how they would affect the cost-to-capacity equation. But he does provide several assertions about the contracting process that may be the basis for his misunderstanding. For example, the Public Representative states that “it appears that there is a capacity ceiling for each contract.”<sup>47</sup> This is not correct, as the Postal Service has the ability to specify increases or decreases in capacity on any contract when it is put out to bid. The Public Representative also states that “it appears that the Postal Service has a ‘rule of thumb’ to negotiate contracts so as to keep excess capacity roughly at 60%.”<sup>48</sup> This is also incorrect. The Postal Service does not “negotiate” contracts, but rather determines the capacity it needs and puts the contracts out for bid. In addition, the Postal Service does not have any preset excess capacity target. Rather, it assesses its need for capacity based upon volume, service and operating requirements, and adjusts that capacity on a case-by-case basis. In sum, there is no basis for the Public Representative’s claim that there are omitted variables in the cost-to-capacity variability.

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<sup>47</sup> Id. at 24.

<sup>48</sup> Id. at 26.