

**BEFORE THE  
POSTAL REGULATORY COMMISSION**

PERIODIC REPORTING  
(UPS PROPOSALS ONE, TWO AND THREE)

Docket No. RM2016-2

**DECLARATION OF T. SCOTT THOMPSON  
ON BEHALF OF  
AMAZON FULFILLMENT SERVICES, INC.**

**January 25, 2016**

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## I. Introduction

### I.A. Qualifications

- (1) My name is T. Scott Thompson. I am a Partner in the Washington, D.C., office of Bates White, LLC (“Bates White”), an economic consulting firm. I specialize in analyzing mergers and acquisitions, horizontal and vertical restraints, and alleged collusive or exclusionary conduct to determine whether they had or are likely to have an adverse effect on competition. Since joining Bates White in 2006, I have conducted antitrust analyses in connection with numerous matters for private parties and government antitrust enforcement agencies, including the Antitrust Division of the United States Department of Justice, the Federal Trade Commission, and the Competition Bureau of Canada, and also have made presentations to those same agencies on behalf of private parties. I have also assisted other Bates White economists in preparation of white papers, expert reports and testimony, including testimony presented in Federal and State courts and before the Federal Communications Commission.
- (2) I have extensive training and experience in the field of econometrics, including regression and other statistical methods. Econometrics is the application of statistical methods to economic problems. The statistical issues involved in econometrics, including appropriate execution and interpretation of regression studies, are also common to many other branches of statistics. I have published papers on econometric methodology in peer-reviewed journals.
- (3) Before joining Bates White, I served for 10 years in various positions at the Antitrust Division of the U.S. Department of Justice. At the Antitrust Division, I was responsible for conducting, supervising, and presenting economic analyses, and making prosecution recommendations, in antitrust investigations and lawsuits relating to mergers and business conduct in a wide range of industries. These included, among others, securities trading, healthcare services (including hospital services), insurance, computer software, consumer products, medical equipment, meatpacking, artificial teeth, paper products,

financial services, semiconductor manufacturing, internet services, telecommunications, telecommunications equipment, and satellite television broadcasting. Because of my background and experience in econometrics, DOJ often assigned me to cases or investigations involving complex or difficult econometric issues or methods. My work included conducting econometric analyses, including regression analyses, for the Antitrust Division, assisting other DOJ experts on their econometric studies, criticizing econometric analysis done by opposing experts, and supervising other DOJ economists performing econometric analyses.

- (4) I played an important role in numerous significant antitrust cases while at the Antitrust Division, including, for example, *United States v. Visa U.S.A., Inc. et. al.* and *United States v. Dentsply International, Inc.* In these and other cases I worked extensively with other expert economists and other expert witnesses retained by the government or by defendants and provided economic consulting support to Antitrust Division attorneys prosecuting alleged violations of the antitrust laws.
- (5) Because of my background as an educator and researcher in the field of econometrics, I was often asked while at the Antitrust Division to serve in educational or advisory positions not generally part of the job responsibilities for most Division economists. For example, I taught and organized seminars in econometrics for other economists and for Division attorneys. I served on a panel at the Federal Trade Commission evaluating econometric research on the competitive effects of mergers in the petroleum industry. And I served as an advisor and consultant on investigations, competition issues and related empirical research to the Grain Inspection, Packers and Stockyards Administration of the United States Department of Agriculture. I was awarded the Assistant Attorney General's Distinguished Service Award by the Antitrust Division in 2001.
- (6) My position when I left the Antitrust Division was Assistant Chief of the Economic Regulatory Section.

- (7) Before joining the Antitrust Division, I served on the faculty of the Department of Economics at the University of Minnesota from 1987 to 1994, where I conducted research and taught graduate level and undergraduate courses, primarily in the field of econometrics. My research and teaching involved extensive use and examination of regression and other statistical methods.
- (8) From 1978 to 1981, I worked as a junior analyst of the Congressional Budget Office, where I contributed to economic analysis of federal programs and proposed federal programs. This work frequently involved regression analysis of large and complex data sets.
- (9) I received my Ph.D. in Economics from The University of Wisconsin in 1989, my M.A. in Economics from The University of Wisconsin in 1984, and my A.B. in International Relations from Stanford University in 1978 (also completing requirements for the Economics major). My Ph.D. thesis analyzed existing methods and proposed new regression methods for evaluating nonlinear models of discrete data under weak restrictions on the data process.
- (10) I have published economic articles in peer-reviewed journals, such as the *Journal of Econometrics*, and co-authored a chapter in the ABA Section of Antitrust Law handbook *Econometrics: Legal, Practical, and Technical Issues*. Many of these articles involve extensive examination of statistical methods.
- (11) My curriculum vitae appears in Appendix A.

## **I.B. Assignment**

- (12) I have been asked by Amazon.com, Inc. (“Amazon”), the parent of Amazon Fulfillment Services, Inc., to evaluate UPS Proposal Two in this docket (“UPS Proposal Two”) and the associated analysis in the Report of Dr. Kevin Neels Concerning UPS Proposals One, Two, and Three, dated October 8, 2015 (“the Neels Report”) and to report on the reliability of the methodology used by Dr. Neels to identify “hidden variable costs” in

some Postal Service cost components. I was asked to comment from the perspective of an econometrician whether the methodology reliably establishes a causal effect of mail volume (as measured by Dr. Neels) on the “reported fixed cost” of certain components, and whether the methodology permits a reliable calculation of the magnitude of variable costs allegedly hidden in these components, so that they might be distinguished from fixed costs and attributed to classes or types of mail service. I was also asked to comment on whether empirical methods can reliably distinguish inframarginal from fixed costs—a problem relevant to both UPS Proposal One and UPS Proposal Two.

- (13) All of the calculations and analyses described in this Declaration can be found in library reference AFSI-LR RM2016-2/1 in this docket.

### **I.C. Summary of UPS Proposal Two and the associated analysis in the Neels Report**

- (14) UPS Proposal Two states, “The Postal Service should not be permitted to treat costs as ‘fixed’ unless it can demonstrate that they are, in fact, fixed, using sound econometric methods.” UPS Proposal Two appears to adopt Professor John Panzar’s definition of fixed costs—the “jump discontinuities at the origin,” or, in plain language, the “significant levels of costs that must be incurred in order to produce even a vanishingly small level of output.”<sup>1</sup>
- (15) UPS Proposal Two relies heavily on pages 31-51 of the Neels Report. According to UPS, “Dr. Neels has identified 37 cost pools that the Postal Service classifies as fixed but that are actually fully or partially variable, as demonstrated by econometric tests with statistically significant results.”<sup>2</sup> UPS proposes that “The Commission should require the Postal Service to update its classification of these 37 cost pools and attribute the variable portion thereof to products, including competitive products.”<sup>3</sup>

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<sup>1</sup> UPS Proposal Two at 2.

<sup>2</sup> *Id.* at 1.

<sup>3</sup> *Id.* at 1.

- (16) The portion of the Neels Report on which UPS Proposal Two relies asks “whether and to what extent the actual changes in Postal Service costs that have occurred in recent years are consistent with assumptions underlying Postal Service costing procedures about which of its costs are fixed.”<sup>4</sup>
- (17) To answer this question, Dr. Neels uses the following procedure. First, he defines fixed costs as “costs that do not change in response to changes in the volume of any product and are not incurred to support the provision of any specific product.”<sup>5</sup> He then “isolates” fixed costs for each Postal Service cost component following a methodology used by Charles McBride in a 2014 contractor report to the Commission.<sup>6</sup> This methodology involves subtracting volume-variable costs and product-specific fixed costs from total costs to obtain institutional costs,<sup>7</sup> which therefore consist of inframarginal costs and fixed costs not attributed to specific products. Further following the McBride approach, Dr. Neels then subtracts from this measure of institutional costs an estimate of inframarginal costs (if any). The remainder, which Dr. Neels calls “reported fixed costs,” is the starting point for his search for “hidden variable costs.”
- (18) Neels excludes from his statistical modeling of individual cost components (1) any cost components for which these “reported fixed costs” were zero in any year during FY2007 through FY 2014 or institutional costs were negative in FY2014, (2) any cost components that were new during the period of study, and (3) component 681 (Domestic Alaska Air). After these exclusions 84 cost components remain.
- (19) Dr. Neels then performs a set of 85 regressions: one for each of these 84 components plus one for a measure of “total fixed cost” calculated by summing reported fixed costs

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<sup>4</sup> Neels Report at 2.

<sup>5</sup> Neels Report at 9. This definition is slightly different from the one offered by UPS based on Dr. Panzar’s paper, since it excludes costs that would otherwise be considered fixed but that are attributable to specific products. However the difference is immaterial to the arguments made here.

<sup>6</sup> Charles McBride, *The Calculation of Postal Inframarginal Costs* (2014) (available at <http://www.prc.gov/sites/default/files/reports/McBride%20092814.pdf>).

<sup>7</sup> Institutional costs are frequently labeled “Other” costs by McBride.



across all cost components, except those in categories 18.3.4 (Workers Compensation) and 18.3.6 (Annuitant Health Benefits and Earned CSRS Pensions). Each regression has a cost variable as the dependent variable and a single independent variable, or regressor, described as “weighted mail volume.” The first regression compares “weighted mail volume” with “total fixed cost.” The remaining 84 regressions focus on a separate measurement of fixed costs for each of the 84 individual cost components. Each regression is calculated from eight annual data points measuring these variables in each of the fiscal years 2007-2014. Based on a finding of a “positive and significant slope” in 37 of these regressions, Dr. Neels concludes that the corresponding cost components have “hidden variable costs.”<sup>8</sup> For those 37 components, Dr. Neels then estimates the magnitude of the “hidden variable costs” by multiplying the slope coefficients in the 37 corresponding regressions by the corresponding measure of weighted mail volume.

- (20) Dr. Neels’ procedures and results are idiosyncratic in several respects. First, all of his regression equations are univariate—that is, Dr. Neels uses no explanatory variables other than weighted mail volume, and thus does not allow for the possibility that other causes (e.g., changes in relative input prices, advances in postal technology, or other non-volume factors) might have been responsible for all or part of the reported changes in the magnitude of the cost components during the eight-year study period.
- (21) Second, for 31 of these 37 regressions that Dr. Neels interprets as revealing “hidden variable costs,” the constant term of the regression, which Dr. Neels interprets as “the predicted ‘truly’ fixed cost for that component,” is negative. Dr. Neels, acknowledging that a negative fixed cost “is not conceptually plausible,”<sup>9</sup> arbitrarily replaces each of these regressions with an alternative regression lacking a constant term, thereby effectively forcing the result that these cost components have no “truly” fixed costs. He

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<sup>8</sup> The Neels Report also offers a “simple binomial test” of the proposition that the proportion of component regressions with positive slopes equals 0.5 – a result he claims we should expect “if fixed costs were fixed.” He rejects this proposition using his test.

<sup>9</sup> Neels Report at 44.

does not investigate the possibility that either statistical error, data errors or misspecifications in the functional forms of his models might have obscured the existence and magnitude of fixed costs in the cost components with positive and statistically significant slope coefficients.

- (22) Third, for 17 of the remaining 47 component-specific regressions, the regression results indicate the slope coefficient is negative, a result that is also anomalous. (The marginal or incremental cost of additional volume would be expected to be positive or zero, not negative.) Dr. Neels concedes that “Taken on its face, this result would imply that adding mail to the system reduces fixed cost”—a result that he acknowledges “a priori to be implausible.” Dr. Neels attributes these results to “statistical noise.”<sup>10</sup> But these counterintuitive results appear to have a cause more fundamental than random error. UPS subsequently reported that 8 of the 17 negative slope coefficients are statistically significant,<sup>11</sup> and that the “implied variable costs” for 11 of the 17 associated cost components “are strongly negative”—a result that Dr. Neels does not believe is plausible.<sup>12</sup> In fact, UPS reported that for seven of the components “the negative ‘hidden variable costs’ outweigh the total cost of the segment,” a result UPS characterized as “an even less plausible result.”<sup>13</sup>
- (23) Fourth, Dr. Neels’ analysis is one-sided. A complete analysis of whether existing Postal Service costing methodologies understate the extent to which costs vary with volume should examine not only whether costs currently regarded as fixed in fact contain “hidden variable costs,” but also whether costs currently regarded as volume variable in fact contain “hidden fixed costs.” The Neels Report, however, considers only the former question, and ignores the latter.<sup>14</sup>

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<sup>10</sup> *Id.* at 43.

<sup>11</sup> United Parcel Service, Inc.’s Response to Chairman’s Information Request No. 1 (Final) at Table 2.

<sup>12</sup> *Id.* at 38-39.

<sup>13</sup> *Id.* at 39.

<sup>14</sup> *Id.* at 30.

- (24) The Neels Report analysis cited in UPS Proposal Two is the only quantitative support offered by either UPS or Dr. Neels in support of UPS Proposal Two. Hence, the validity of UPS Proposal Two stands or falls on the validity of Dr. Neels' regression analysis.<sup>15</sup>

## **II. The Neels Report fails to reliably identify the presence of “hidden variable costs” in reported fixed costs.**

### **II.A. Dr. Neels' analysis ignores the possibility that changes in reported fixed costs during FY 2007-2014 resulted from confounding causes other than “weighted mail volume.”**

- (25) The most basic flaw in Dr. Neels' regression analysis is his failure to identify and account for potential causes of changes in reported fixed costs *other than* weighted mail volume, for example by including additional explanatory variables in his regression that would control for possible alternative causes. Because of this omission, his univariate regressions cannot prove a causal relationship.
- (26) To be sure, his regressions purport to show a correlation during the eight year study period between weighted mail volume and reported fixed costs. Indeed, the estimated slope parameters in his regressions are mathematically equal to the correlation times the

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<sup>15</sup> The 2014 report to the Commission by Mr. McBride does not provide independent support for Dr. Neels' regression analysis. For most of the 84 cost components analyzed by Dr. Neels, the McBride methodology determined that they were 100% fixed. That is, no inframarginal costs were subtracted from institutional costs and so reported fixed costs equal institutional costs for these components. For a few “dependent” components, however, some inframarginal costs were subtracted to obtain reported fixed costs. Any errors in estimating these inframarginal costs could introduce errors in reported fixed costs that are correlated with volume, causing bias in the subsequent regression analysis. Although I have not investigated the reliability of McBride's methodology, I note that his goal was “to calculate a relatively accurate estimate of system-wide inframarginal costs,” and not to provide accurate measures of inframarginal costs for each component separately. (McBride, *supra* note 6, at 7) For reasons discussed further in Section IV, statistical methods cannot reliably distinguish inframarginal from fixed costs using historical Postal Service data of the sort examined in the Neels Report.

ratio of the standard deviation of fixed cost to the standard deviation of weighted mail volume. This is a trivial result, however: mere correlation does not imply causation. “A large value of  $r$  [the correlation coefficient] means only that the dependent variable marches in step with the independent one: Possible reasons include causation, confounding, and coincidence.”<sup>16</sup>

- (27) “Coincidence” is a correlation that is due solely to happenstance, and no economic relationship actually exists between the explanatory and independent variable at all. Such measured correlations, known as “spurious” correlations, are well described in the statistics literature.<sup>17</sup> They are especially common in time series regressions like Dr. Neels’, in which the time period studied is relatively short.
- (28) A second form of spurious correlation results from failure to rule out the possibility that the reported correlation is due, at least in part, to causes not represented by explanatory variables in the regression model. These other variables are commonly referred to as “confounding” variables. The presence of confounding variables not accounted for in a regression is a textbook violation of the assumptions that must be satisfied for a

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<sup>16</sup> David H. Kaye & David A. Freedman, “Reference Guide on Multiple Regression,” in Federal Judicial Center, *Reference Guide on Statistics, in Reference Manual on Scientific Evidence* 264 (3d ed. 2011). See also Darrell Huff, *How to Lie with Statistics* (W.W. Norton, 1982) at chapter 8 (“Post Hoc Rides Again”). For some historical perspective on the relationship between correlation and causation see John Aldrich, “Correlations Genuine and Spurious in Pearson and Yule,” *Statistical Science* (1995, Vol. 10., No. 4), 364-376.

<sup>17</sup> In fact, spurious correlations can exist even between longer time series exhibiting trends. See, for example, C.W.J. Granger and P. Newbold, “Spurious Regressions in Econometrics,” *Journal of Econometrics* 2 (1974), 111-120. Many striking examples of large but completely spurious regressions among short time series are presented in Tyler Vigen, *Spurious Correlations* (Hachette, 2015) and on the associated website <http://www.tylervigen.com/spurious-correlations> (noting the near-perfect correlation of 0.992 during 1999–2009 between (1) U.S. spending on science, space and technology and (2) suicides by hanging, strangulation and suffocation). See also the close correlation between the monthly changes in stock prices on the New York and London stock exchanges and the inverse of monthly changes in solar radiation in 1929 in Edward R. Tufte, *The Visual Display of Quantitative Information* (2d ed. 2001) at 15.

regression to produce reliable results. The coefficient estimates in such a regression will suffer from omitted variable bias if the omitted variables are correlated with the included variables.<sup>18</sup> Such bias in the slope coefficients in Dr. Neels' regressions would bias his estimate of "hidden variable costs", and could easily explain some or all of the results that Dr. Neels characterized as implausible. In addition, the omitted variable bias also distorts the measures of statistical significance on which Dr. Neels relies, rendering them unreliable.

- (29) The level of reported fixed costs could have been influenced by many causal factors other than volume during FY 2007 to FY 2014. For example, if input factor prices changed in real (inflation-adjusted) terms during that period, overhead costs depending on those input prices would likely have changed independently of mail volume. Changes in the level or mix of inputs used by the Postal Service during the same period very well could have affected fixed costs independently of mail volume, whether in response to changing input prices, or for other reasons, such as efforts to improve efficiency or reduce costs of activities not related to mail volume. To the extent that reported fixed costs include investment expenses, accounting accruals, or regulatory costs, these may also change over time due to a variety of causes other than changes in mail volume.
- (30) As noted by Dr. Neels, the recession that started late in 2007 had large effects on the Postal Service, causing large declines in mail volume over the course of a few years. Far from being a "natural experiment"<sup>19</sup> in which volume changed independently of other

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<sup>18</sup> See William H. Greene, *Econometric Analysis, Sixth Ed.* (Pearson, 2008) at 133-134.

<sup>19</sup> The New Palgrave Dictionary of Economics defines a "natural experiment" as follows: "Natural experiments or quasi-natural experiments in economics are serendipitous situations in which persons are assigned randomly to a treatment (or multiple treatments) and a control group, and outcomes are analysed for the purposes of putting a hypothesis to a severe test; they are also serendipitous situations where assignment to treatment 'approximates' randomized design or a well-controlled experiment." DiNardo, J., "Natural experiments and quasi-natural experiments," *The New Palgrave Dictionary of Economics*, Eds. Steven N. Durlauf and Lawrence E. Blume, Palgrave Macmillan, 2008, *The New Palgrave Dictionary of Economics Online*, Palgrave

changes in the economic and regulatory environment faced by the Postal Service, the recession had profound effects throughout the U.S. economy. These included changes in labor, real estate, financial, and energy markets, retail commerce, and in the financial constraints faced by the Postal Service.<sup>20</sup> It is implausible that none of these had any effect on Postal Service fixed costs, independently of declining mail volume, as Dr. Neels assumed.

- (31) In some cases it may be possible to identify confounding effects explicitly, but doing so would require careful examination of the underlying activities and decisions of the Postal Service in order to identify relevant cost drivers—steps that Dr. Neels did not undertake. Additional discussion of factors driving variation in reported fixed costs by component not caused by changes in mail volume can be found in the separate Declaration of Sander Glick. Mr. Glick notes, among other things, that the downward trend in cost component 70 (Rural Carrier – Other Routes) is driven by a shift in the mix of rural routes between “evaluated” and “other” rural routes—a distinction unrelated to mail volume. Following Mr. Glick’s suggestion, I pooled cost component 70 with cost component 69 (corresponding to evaluated rural routes) and re-ran Dr. Neels’ regression for the pooled components. Upon doing so, I found that the slope coefficient was negative, indicating there are no “hidden variable costs” in these components per Dr. Neels’ methodology.
- (32) The Commission has long emphasized the importance of controlling for potential confounding causes in regression analysis. In Docket No. R76-1, *Rate and Fee Increases, 1975*, for example, the Office of the Commission (the predecessor of the Public Representative) submitted a regression study that compared USPS costs with various measures of mail volume at 87 large post offices. The Commission, noting that both the cost and volume variables “might be independently varying over time resulting in a

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Macmillan. accessed 08 January 2016 at  
[http://www.dictionaryofeconomics.com/article?id=pde2008\\_N000142](http://www.dictionaryofeconomics.com/article?id=pde2008_N000142)

<sup>20</sup> Order No. 547 in Docket No. R2010-4, *Rate Adjustment Due to Extraordinary or Exceptional Circumstances* 50 (Sept. 30, 2010), *remanded on other grounds, USPS v. PRC*, 640 F.3d 1263 (D.C. Cir. 2011).

‘spurious’ correlation of the data,” found that the inferences of causation drawn by the Office of the Commission from the reported correlation “was not supported, and seems insupportable.”<sup>21</sup>

- (33) Similarly, in Order No. 1926 in Docket No. R2013-11, *Rate Adjustment Due to Extraordinary or Exceptional Circumstances*, pp. 64-69 (Dec. 24, 2013), the Commission disallowed recovery of billions of dollars of contribution attributed by the USPS to the 2007-2009 recession on the ground that the USPS regression study had failed to include an explanatory variable that could separate the effects of the recession on mail volume from the effects of internet or electronic diversion. On judicial review, the Court of Appeals upheld this part of the Commission’s decision:

The Postal Service bore the burden of showing its net losses from the recession. And substantial evidence supported the Commission's determination that the Postal Service had not proved that its linear intervention variables reliably captured only the effects of the recession. Most glaringly, Thress's models had no separate variable to account for loss of mail volume to the Internet. So if people shifted to email at a faster pace during the recession than before, that effect would have been swept up wholesale in the linear intervention variables as attributable to the recession, rather than as, perhaps, the simple progress of inevitable change.<sup>22</sup>

- (34) Dr. Neels tries to brush off his failure to rule out confounding causation for the changes in reported fixed costs between FY 2007 and FY 2014 on the theory that reported fixed costs should exhibit no variation at all over time—from any cause—because reported fixed costs are calculated as residual values after all potential cost drivers other than volume have been taken into account:

The Postal Service might argue that the regression analyses underlying these results are based upon an overly simplistic model that does not take into account the different factors that might influence postal operations

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<sup>21</sup> R76-1 Op. & Rec. Decis. 90-91 & n. 3 (June 30, 1976).

<sup>22</sup> *Alliance of Nonprofit Mailers v. PRC*, 790 F.3d 186, 195 (D.C. Cir. 2015).

and postal costs. However, these arguments do not apply to the results discussed above. *The costs that form the dependent variables in these regressions are the costs remaining after the effects of all other costs drivers have, at least according to the Postal Service, been appropriately taken into account. These are supposed to be fixed costs, and so there is not supposed to be any other source of variation left to be taken into account.*<sup>23</sup>

- (35) Thus, Dr. Neels contends, if the Postal Service's costing procedures are accurate, "it should be the case that in response to historic declines in mail volumes, variable costs decline, while fixed costs remain fixed."<sup>24</sup> Indeed the "truly" fixed costs that he claims to uncover using statistical methods do not change at all from year to year.<sup>25</sup>
- (36) This extraordinary claim is unfounded and incorrect. Dr. Neels provides no citations to Postal Service documents or statements substantiating this claim. The only cost drivers that have been accounted for in the calculation of reported fixed costs as calculated by Dr. Neels are those related to mail volume<sup>26</sup> or fixed costs attributable to specific products.
- (37) More fundamentally, Dr. Neels' assumption that fixed costs do not vary over time for any reason ignores the very definition of fixed costs. Costs are fixed rather than variable, as a matter of economics, when they do not vary with the level of output, holding

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<sup>23</sup> Neels Report at 46 (emphasis added).

<sup>24</sup> Neels Report at 31.

<sup>25</sup> Dr. Neels' "truly" fixed cost measure is not simply the difference between reported fixed costs and "hidden" variable costs, as is evident in his Figure 11. The difference is accounted for by the regression residuals in his statistical models. Dr. Neels makes no specific statement about whether he considers the regression residuals to be fixed costs, variable costs or something else. However his regression procedure implicitly assumes that any regression disturbances are uncorrelated with weighted mail volume and so cannot be due to any variability in volume. Thus to the extent that Dr. Neels allows for any variability in fixed costs, it is through these residuals, which are uncorrelated with volume by assumption.

<sup>26</sup> The cost drivers used in step 2 – "Identify a Cost Driver and Find Volume Variable Costs" – of the approach for determining volume-variable costs are volume-related measures. FY 2014 Summary Description of USPS Development of Costs by Segments and Components (July 1, 2015), Appendix H.



constant the set of products offered, available technology, and the regulatory and economic environment. Nothing in the definition of fixed costs implies that they do not vary with factors *other than* the level of output. Stated otherwise, fixed cost is a *ceteris paribus* concept that recognizes the possible variability of fixed costs when factors other than output change. Dr. Neels simply assumes away the possibility that *ceteris* are not always *paribus*.

## **II.B. Dr. Neels' econometric results are also rendered unreliable by the small size of his data set.**

- (38) Dr. Neels' regression analysis is undermined by a second fundamental flaw: he has failed to use a big enough data set to obtain reliable results. Each of Dr. Neels' regressions is calculated from just eight annual data points. Such a small set of data is insufficient for conducting reasonable statistical inference. Among other things, it is impossible to calculate measures of statistical significance or other measures of statistical reliability from such a small data set without making very strong assumptions.
- (39) In particular, Dr. Neels' calculations of statistical significance are based on an assumption implicit in his calculations that the regression disturbances (the part of reported fixed costs not accounted for by the regression line itself) have a "normal" or "Gaussian" probability distribution. Dr. Neels' calculations of statistical significance are also based on formulas that implicitly assume that the regression disturbances have a uniform degree of variability over time (i.e. are "homoskedastic") and are uncorrelated with each other—an assumption that typically does not hold in time series data of the sort he relies on. In large data sets these assumptions may be testable, or avoidable altogether.<sup>27</sup> But there is no real hope of testing them reliably with just eight data points. *Cf.* R76-1 Op. & Rec. Decis. 85 & n. 2 (June 30, 1976) (rejecting as unreliable a time-series regression of volumes against costs based on "10 or more years" of data).

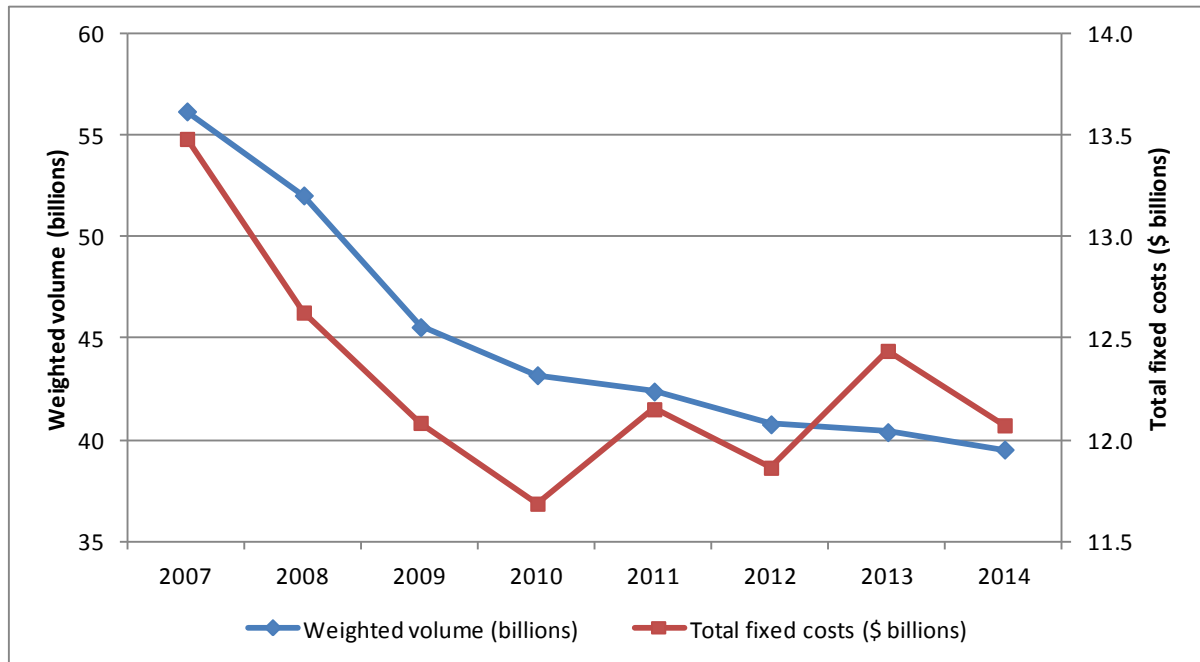
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<sup>27</sup> For example, statistical inference based on asymptotic approximations may be reliable in very large data sets provided certain conditions are met that are substantially weaker than those needed for inference in small data sets.

**II.C. The methodological flaws in Dr. Neels’ analysis of total reported fixed costs are reflected in the instability and wide confidence intervals of his results.**

- (40) The specification errors in Dr. Neels’ model, and the limited size of his data set are reflected in the poor results he obtained. The results are highly sensitive to changes in the period analyzed, and confidence intervals for his results are very wide. Indeed deleting a single data point from his data can render his findings statistically insignificant.
- (41) Data from Dr. Neels’ Table 7, which are the basis for his Table 8 regression results, are displayed in Figure 1. While weighted mail volume declined throughout the period studied in the Neels Report, total reported fixed costs did not show a similar pattern of decline. Rather, fixed costs declined from 2007 through 2010 and then recovered somewhat. Total reported fixed costs fluctuated from 2009 to 2014 around a slight upward trend.

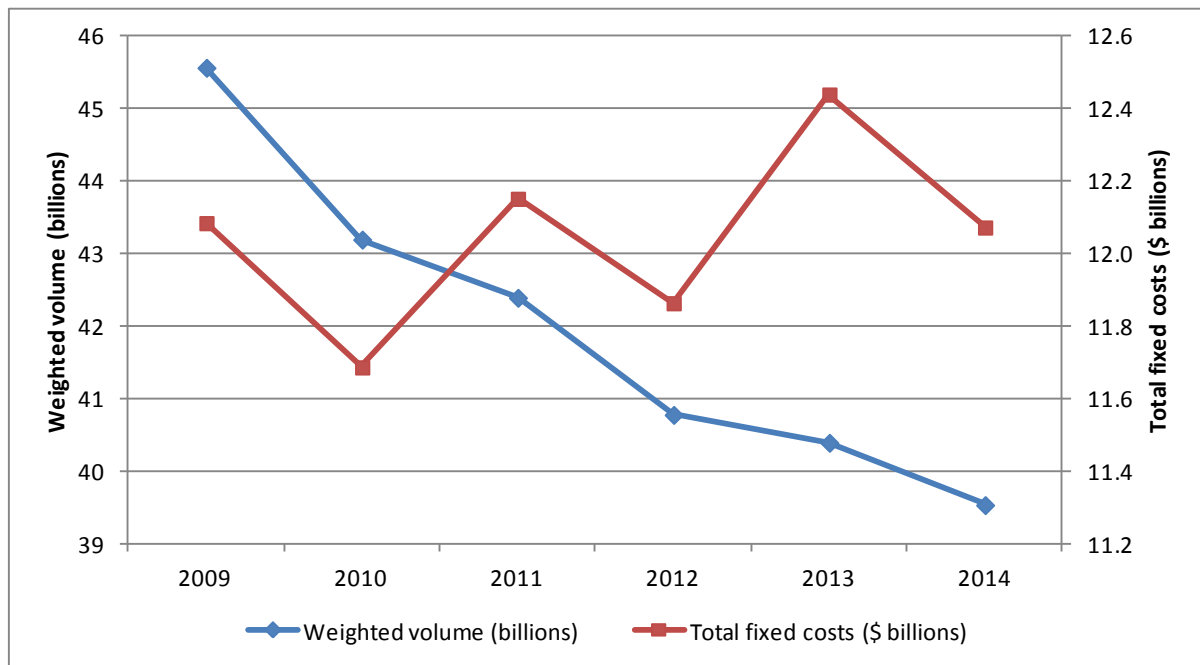
**Figure 1. Weighted mail volume and total reported fixed costs**



Source: Neels Report, Table 7

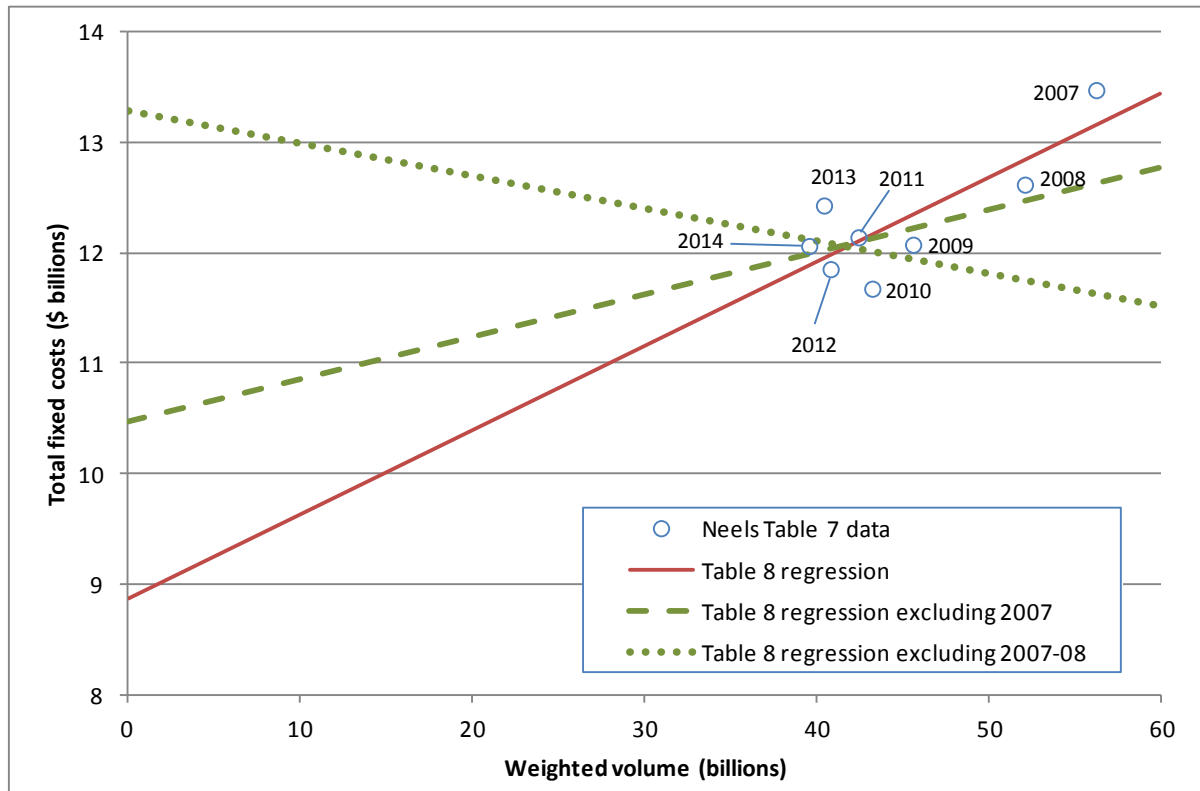
(42) It is clear from the figure that the years 2007 and 2008 are not representative of more recent experience. This fact is even more apparent in Figure 2, which shows the same data with 2007 and 2008 removed, and in Figure 3, which shows the data from Table 7 of the Neels Report in scatter plot form (circles), as well as regression results from Table 8 of the Neels Report (solid line). Two dashed lines in Figure 3 show the impact on Table 8 of the Neels Report that results from deleting the data points for 2007 or for both 2007 and 2008. Deleting 2007 data significantly reduces the slope of the regression line. Figure 2 and Figure 3 show that over the last six years of data there was a negative correlation between weighted volume and reported fixed costs. Thus deleting both 2007 and 2008 from the regression makes the slope coefficient negative—a result that Dr. Neels argues is implausible. Only the presence of the two oldest years in the data—years when the economy looked quite different from today in many respects other than mail volume—allows Dr. Neels to find “hidden variable costs” in the total fixed costs he considered and prevents him from finding implausible results.

**Figure 2. Weighted mail volume and total reported fixed costs with 2007 and 2008 removed**



Source: Neels Report, Table 7

**Figure 3. Weighted mail volume and total reported fixed costs scatter plot with associated regressions**

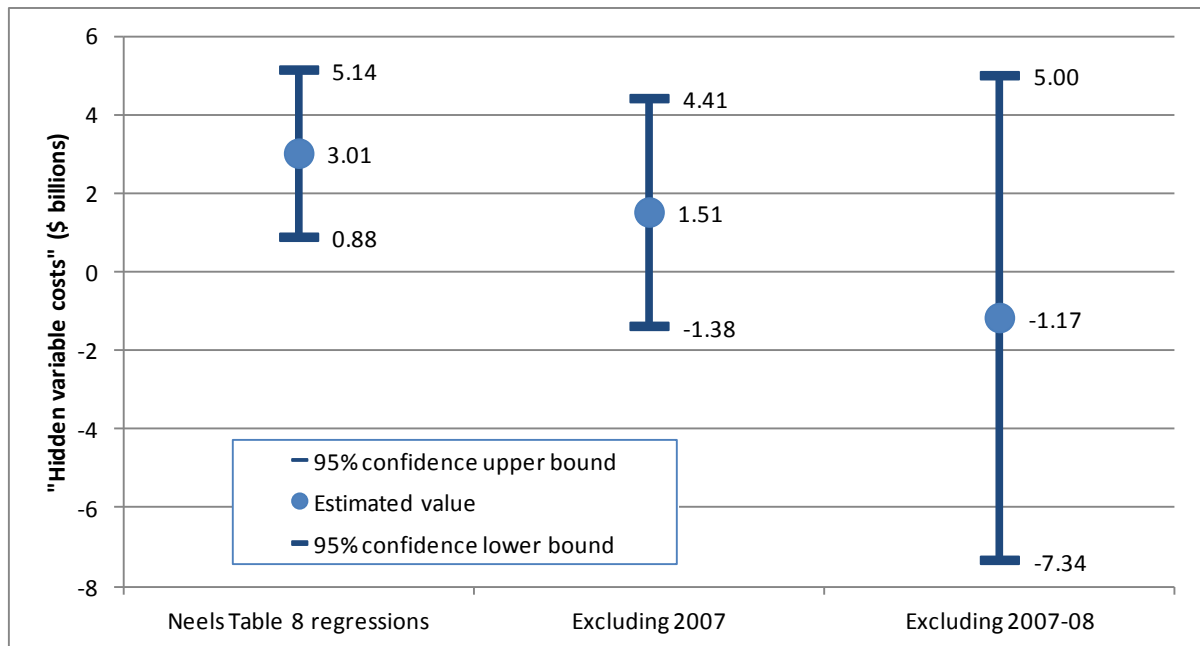


Source: Neels Report Tables 7 and 8 and author’s analysis

- (43) Also noteworthy is the dependency of the intercept (or “constant”) in these regressions on the same two data points. The intercept in these regressions is the same as Dr. Neels’ “Truly Fixed Cost” displayed in his Figure 11. Figure 3 makes clear that simply excluding 2007 from the analysis increases Dr. Neels’ “Truly Fixed Costs” by \$1.60 billion (i.e., from \$8.87 billion to \$10.47 billion)—an increase of 18%. Also, deleting 2008 increases the “Truly Fixed Costs” estimated by the regression much further, to \$13.29 billion—a figure that exceeds total reported fixed costs in every year except 2007.
- (44) Thus, Dr. Neels’ calculations of variable costs allegedly hidden in total reported fixed costs is highly sensitive to the oldest two years of data he examined—years when the economy looked very different from today due to the start of the Great Recession.

(45) Dr. Neels did not report statistical confidence intervals for the “hidden variable costs” he claims to have uncovered. But his own regressions indicate that a very high level of statistical uncertainty surrounds his estimates. For example, Figure 4 shows 95% confidence intervals for “hidden variable costs” for 2014 calculated from the same three regression lines as displayed in Figure 3. Even using Dr. Neels’ original Table 8 regression, the possible values for “hidden variable costs” could be as low as \$0.88 billion or as high as \$5.14 billion. By comparison, the total reported fixed costs in which these variable costs are supposedly hidden is \$12.07 billion. When either 2007, or 2007 and 2008, are excluded from the regressions, the upper bound on “hidden variable costs” changes relatively little, but the lower bound becomes negative. This implies that “hidden variable costs” would not be found to be statistically significantly different from zero by Dr. Neels but for the inclusion of the two oldest and least representative data points in the regression. In fact when both 2007 and 2008 are excluded, *the 95% confidence interval is wider than the total reported fixed costs.*

**Figure 4. 95% confidence intervals for 2014 “hidden variable costs” using Dr. Neels’ methodology**



Source: Author’s calculations from the regressions displayed in Figure 3.

## II.D. Additional problems with Dr. Neels' "component level" analysis

### II.D.1. Dr. Neels' "component level" regressions often produce results that he admits are implausible.

- (46) Figures 1-4 above and the related discussion focused on Dr. Neels' data on total reported fixed costs presented in his Table 7 and the related statistical results in his Table 8 and Figure 11. I turn next to Dr. Neels' results for the 84 univariate "component level" linear regressions that he calculated. Via a decision tree based on the signs of estimated slope and intercept coefficients and their statistical significance, Dr. Neels decided that his model was appropriate for some of the 84 cost components but not for others, where he accepted the Postal Service methodology.
- (47) I visually examined scatter plots similar to Figure 3 for each of the 84 components. The variety of patterns one sees in the underlying data is striking. In some cases one sees evidence of variables displaying trends, which as noted previously can lead to spurious correlations. The scatter plot for others often appears to display a nonlinear pattern. Data points for 2007-2009 are quite different from more recent data in some cases. For many components there is no obvious pattern. The sheer variety of these data suggests that no simple univariate statistical model could be adequate for all of them.
- (48) The visual patterns are reflected in a lack of consistency in Dr. Neels' regression results. For example, he finds negative intercepts in 41 of 84 (almost half) of the regressions. Of these, 19 (or 23% of all regressions) have a statistically significant negative intercept according to Dr. Neels' methodology.<sup>28</sup> Such a finding implies "truly fixed costs" that are *negative*—a result that Dr. Neels admits "is not conceptually plausible."<sup>29</sup> All 19 of these cost components with statistically significant but negative intercepts are among the 37 components for which Dr. Neels concludes there are significant "hidden variable costs".

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<sup>28</sup> Neels backup material: "Component Fixed Cost Regression Results.xlsx" in Library Reference UPS-RM2016-2/LR-NP1

<sup>29</sup> Neels Report at 44.

- (49) Dr. Neels also recognizes that a negative slope coefficient is “a priori implausible” because it would imply that total costs decline when mail volume rises.<sup>30</sup> But he found negative slopes in 17 component regressions. He attributes this to “statistical noise.”<sup>31</sup> However, eight of the negative slope coefficients are statistically significant, which is more than one would expect if statistical noise were truly the cause.<sup>32</sup>
- (50) Dr. Neels does not seem to consider the possibility that these unexpected statistically significant results might imply problems with his methodology. As previously explained, however, each of the 84 regressions suffers from inattention to possible confounding influences, creating a likelihood of omitted variable bias that could explain the conceptually implausible results. Furthermore, the measures of statistical significance he uses in his decision tree suffer from the same dependence on strong and unverifiable assumptions previously discussed for the total fixed cost analysis. It is likely that they also are sensitive to the presence or absence of individual data points, and that they imply a high degree of statistical uncertainty for the estimates of alleged “hidden variable costs.”

**II.D.2. Dr. Neels’ binomial test of the pattern of regression coefficients is unreliable for detecting the presence of “hidden variable costs”**

- (51) As summarized in his Table 10, Dr. Neels examined the sign of the slope coefficients for the 84 component regressions and found that 67 of them were positive. He formally tests the hypothesis that the count of positive results follows a binomial distribution with  $p$  equal to 0.5, and he rejects this hypothesis because the implied probability of observing

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<sup>30</sup> Neels Report at 43.

<sup>31</sup> Neels Report, fn 59.

<sup>32</sup> Under Dr. Neels’ assumptions, if the true slope parameters are all zero then only about 5% of slope coefficients should be found to be statistically significant as a consequence of statistical noise, and these should be evenly distributed between positive and negative values of slope. Thus only 2.5% of slope coefficients should be both statistically significant and negative. The percentage should be even lower if some of the true slope parameters are greater than zero. Yet Dr. Neels finds 8 out of 84 or almost 10% of the estimated slope parameters are negative and statistically significant.

67 positive coefficients out of 84 is very small. However, his conclusion “that there is systematic bias that tends to overstate the fixed costs of the Postal Service”<sup>33</sup> requires significant leaps of faith beyond his binomial test.

- (52) Dr. Neels’ hypothesis of a binomial distribution with  $p$  equal to 0.5 is equivalent to assuming that the signs of the slopes in each of his regressions are determined as if one were flipping a coin 84 times. He is essentially arguing that if the coin is fair then one would not expect to get “heads” 67 times out of 84 tries. But this is an overly simplistic way to think about the results from his regressions.
- (53) The calculation assumes that the probability of positive and negative slope findings would each be 0.5 for each cost component in the absence of any causal relationship with mail volume. The presence of confounding variables likely causes correlations between mail volume and reported fixed costs that are not due to a causal relationship. Furthermore, even if there were no correlation, positive and negative slope findings would be equal only if the probability distributions of the slope estimates have zero medians. In small datasets this is unlikely to hold unless the regression disturbances have a symmetric distribution. Thus, Dr. Neels relies further on his unstated but implied assumption that the regression disturbances have a “normal” distribution.
- (54) The calculation of binomial probabilities also rests on an assumption that the findings in the 84 regressions are statistically independent of each other, just as 84 coin flips are statistically independent. Given the nature of Dr. Neels’ regressions, many of which are based on cost components that are themselves correlated, and/or rely on common measures of mail volume, it would be surprising if the 84 regressions are each independent trials. In any case Dr. Neels presents no evidence or argument to justify the implicit assumption of independent trials.

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<sup>33</sup> Neels Report at 42.



**II.D.3. Dr. Neels' "decision tree" biases his conclusions towards finding "hidden variable costs."**

- (55) As explained in Section II.D.1, many of the 84 component regressions produced results that Dr. Neels found implausible because they implied negative "truly fixed" or negative "hidden variable costs." In fact, of the 84 component regressions that he examined, only 26 had the expected signs for both slope and intercept.
- (56) Dr. Neels dealt with unexpected results through his "decision tree" as laid out in his Figure 12. Per rules in this "decision tree," he ignored his own results whenever slopes were negative, a result that otherwise would imply negative "hidden variable costs" and often would imply "truly fixed" costs far in excess of actual costs. For negative intercepts, which would imply negative "truly fixed" costs and frequently would imply "hidden variable costs" in excess of actual costs, Dr. Neels arbitrarily replaced his univariate regression with an alternative where the intercept is forced to zero. This alternative model assumes that all costs are variable, but avoids the implication that costs vary enough with volume for costs to become negative at lower levels of output. Even this extreme assumption was insufficient to avoid having "hidden variable costs" exceed actual costs in some cases, and so Dr. Neels' also applied an *ad hoc* correction of capping his estimate of "hidden variable costs" for 2014 at the actual cost levels for some components.<sup>34</sup>
- (57) In making these adjustments to his results—discarding some and replacing others with alternatives that presume the presence of significant "hidden variable costs"—Dr. Neels "decision tree" ignores the possibility that unexpected results are due to confounding effects or other problems he did not consider. Instead, Dr. Neels ignored or replaced results that did not fit his preconceptions, ensuring that his results are biased towards a finding of "hidden variable costs." His conclusion, therefore, that Postal Service costing

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<sup>34</sup> This *ad hoc* correction is not described in the Neels Report itself but is evident in Dr. Neels' backup spreadsheet formulas that distinguish between "implied truly fixed costs" and "truly fixed costs." See columns AL-AN of sheet "All Components Datasheet" in the "2 - Fixed Cost Regressions\Component Fixed Cost Regression Results.xlsx" file in Library Reference UPS-RM2016-2/LR-NP1.

procedures are biased towards finding fixed costs is largely due to “confirmation bias” rather than reliable evidence.

### III. A balanced inquiry would also look for fixed costs misclassified as variable.

- (58) Dr. Neels has further biased his results by failing to perform his regression analysis on the cost components that the McBride study classifies as variable. To test whether cost components classified as variable might in fact have “hidden fixed costs,” I ran a regression using the same time period (FY 2007 through FY 2014) used by Dr. Neels and a methodology similar to that used by him, with total attributable cost across all components as a dependent variable, and weighted volume as an independent variable.
- (59) The results are summarized in Figure 5. Unlike Dr. Neels’ regression on total reported fixed costs, this regression fits the annual data on total attributable costs almost perfectly (adjusted R-square of 0.991). Using Dr. Neels’ interpretation of the intercept in such a regression as “truly fixed costs,” one might infer that there are \$8.6 billion in “hidden truly fixed costs” embedded in reported attributable costs—more than twice the \$3.1 billion of “hidden variable costs” for 2014 that Dr. Neels’ regression purports to find in reported fixed costs.

**Figure 5. Regression of total attributable costs on weighted mail volume**

	Coefficient	Standard Error	T-statistic	p-value
Intercept (\$ 000)	8,618,948	1,323,056	6.51	0.001
Slope	0.794	0.029	27.22	<0.001
Number of Observations	8			
Adjusted R Square	0.991			

Source: Author’s calculations

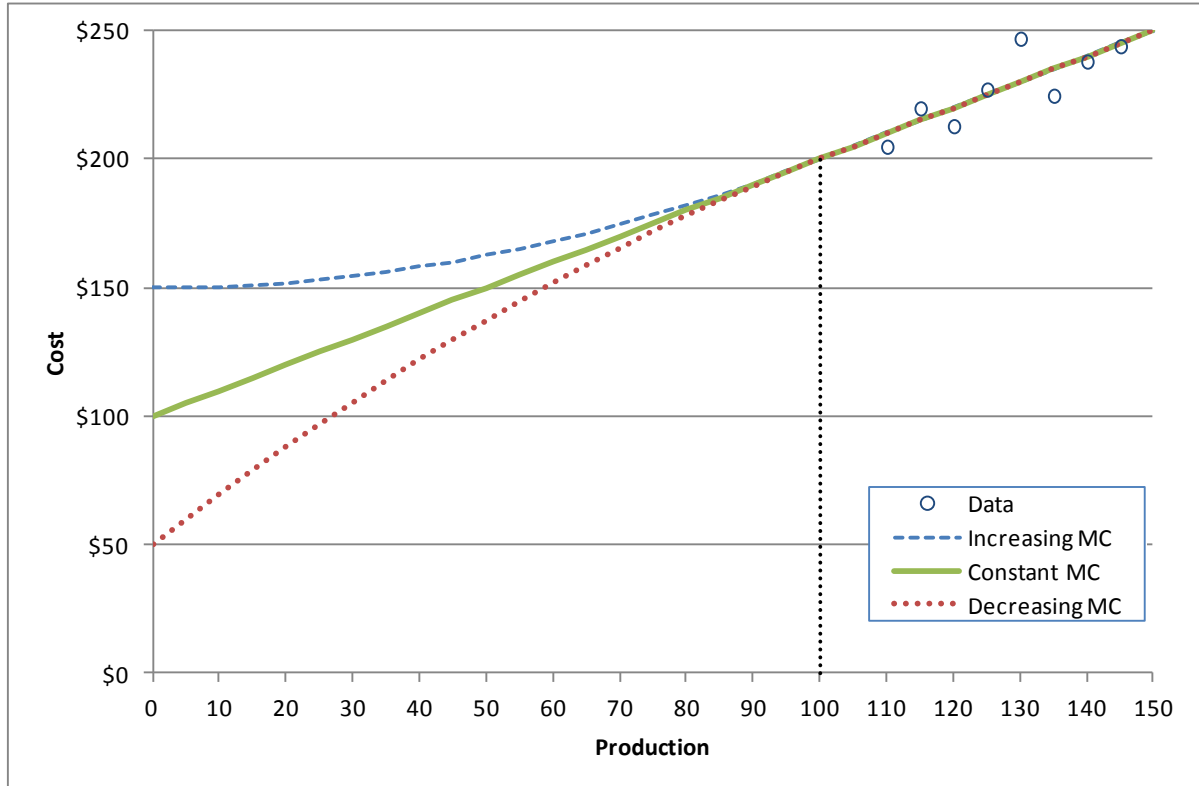
- (60) I am not suggesting that these results offer a reliable means to identify “hidden fixed costs”: they likely suffer from the same methodological and data deficiencies that taint the results submitted to the Commission by Dr. Neels. But Dr. Neels’ failure to apply a similar methodology to attributable costs or other variable costs underscores the one-sided nature of his analysis. And these results show that, ignoring the methodological shortcomings of Dr. Neels’ methods, applying those methods to all of the data would lead to a conclusion that Postal Service costing procedures are biased towards finding too much variability of costs caused by volume changes, rather than too little.

#### **IV. Inframarginal costs cannot be distinguished from fixed costs if historical volumes do not approach zero.**

- (61) Dr. Neels made no attempt to calculate inframarginal costs “hidden” in reported fixed costs. His calculation of “hidden variable costs” multiplies the estimated slope times the weighted mail volume, which (ignoring the many problems with his regressions) would be an appropriate estimate of variable costs only if marginal cost is constant across all levels of output, so that there are no inframarginal costs.
- (62) Furthermore, many of the 170 cost components examined by Dr. Neels include some inframarginal costs, per the McBride methodology that he adopted. These inframarginal costs are the subject of other parts of the Neels Report related to UPS Proposal One, but some of them are also relevant for the analysis related to UPS Proposal Two because Dr. Neels subtracted inframarginal costs from institutional costs in his calculation of reported fixed costs.
- (63) Therefore a question central to both of these proposals is whether one can reliably distinguish inframarginal costs from fixed costs.
- (64) My opinion is that inframarginal costs cannot reliably be distinguished from fixed costs if historical volumes do not approach zero. This is especially true for statistical methods similar to those adopted by Dr. Neels.

- (65) The basis for my opinion is best understood by reference to the stylized example in Figure 6.<sup>35</sup> The figure shows eight hypothetical data points relating total cost to production volume, similar to the data analyzed by Dr. Neels. In this example, a regression of cost on volume yields the solid green line in the figure. The line has an intercept of \$100 and a slope of one dollar per unit of production. If one interprets this line as a representation of a total cost function, then total costs associated with an output level of 100 units are \$200, of which half are fixed costs and half are variable costs. This is what Dr. Neels does in his analysis claiming to find “hidden variable costs.”<sup>36</sup>

**Figure 6. Hypothetical calculation of variable and fixed costs**



<sup>35</sup> The example assumes, as does Dr. Neels, that the observed relationship between production volume and cost is a causal relationship and that there are no confounding effects.

<sup>36</sup> However as discussed previously, Dr. Neels only adopts this procedure exactly when the slope and intercept match his preconceptions, but not when either the slope or intercept are negative.

- (66) Put differently, this process estimates variable and fixed costs by extrapolating the line away from the observed data points until it hits the vertical axis at \$100, corresponding to zero output, as a means of identifying fixed costs. Even if the actual cost function is actually linear (which implies constant marginal cost at all levels of output), any statistical uncertainty about the slope estimate will be magnified by the process of extrapolation, leading to a high degree of uncertainty about variable costs and fixed costs associated with 100 units of output even if the total cost associated with this level of output is measured precisely in the observed data.<sup>37</sup>
- (67) As shown in Figure 4, confidence intervals for Dr. Neels' estimates of "hidden variable costs" are very wide. This undoubtedly is at least partly due to the extrapolation effect. Indeed, to the extent that the lowest level of weighted mail volume in Dr. Neels' data occurred in 2014, as is the case in 82 of his 85 regressions, then his corresponding estimates of "truly fixed" and "hidden variable costs" are based entirely on extrapolation of historical trends to levels of output far below anything that has ever been observed in Postal Service data. Most of his "hidden variable costs" are therefore speculative.
- (68) Any empirical method (statistical or otherwise) for distinguishing fixed from variable costs based on data of this sort is going to have these same problems and more. Results may vary wildly depending on the assumed functional form for the volume-cost relationship. For example, the red dotted line in Figure 6 displays a hypothetical cost function that is linear at output levels greater than 100 but exhibits decreasing marginal costs (i.e. scale economies) at lower levels of output. Fitting this cost curve to the available data using regression yields the dotted red line. Although the fitted regression is exactly the same as before for levels of output observed in the data, the implied fixed costs are now only \$50 because of the presence of \$50 in inframarginal costs represented by the difference in intercepts relative to the constant marginal cost line.

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<sup>37</sup> This is due to the fact that a univariate regression line must pass through a point defined by the average values of the independent and dependent variables. Therefore small changes in the data will tend to move the line very little in the vicinity of the observed data points, but may move it a lot at values far from the observed data.

- (69) At first glance the uncertainty might seem no worse than before: The intercept will have similar variability to the linear case. However this is true only if the shape of the cost curve is known precisely so that there is no uncertainty about the degree of curvature of the cost function at low levels of output, or put differently, only if we have precise information already about the magnitude of inframarginal costs. Consider, for example, an alternative cost function with increasing marginal costs (i.e. diseconomies of scale) as represented by the dashed blue line. This cost function implies a fixed cost of \$150 and thus only \$50 of variable costs associated with 100 units of output. Considering alternative cost functions—all approximately equivalent in the vicinity of the observed data—permits the analyst to make almost any split between fixed and variable costs seem possible. The available data might be able to tell us something about economies or diseconomies of scale near the observed data points, but they will never be able to reliably predict costs at levels of output far below those observed in the data.
- (70) Thus any attempt to distinguish fixed from variable costs will necessarily rely heavily on assumptions about the shape of the cost function that cannot be tested using data, assuming that actual mail volume levels do not approach zero. Even if the slope of the cost function can be measured precisely in the vicinity of the observed data, any distinction between fixed and inframarginal costs will necessarily be driven primarily by assumptions rather than empirical evidence under these circumstances: If there is no data about costs at volumes approaching zero then there is no data that permits one to distinguish fixed costs from inframarginal costs.
- (71) The potential for confusion between inframarginal and fixed costs when using procedures similar to those adopted by Dr. Neels is apparent in a regression similar to the one reported in Figure 5 but using the sum of attributable and inframarginal costs as the dependent variable. This regression is reported in Figure 7. The results are very similar to those in Figure 5, except that the intercept is much greater. Indeed if we follow Dr. Neels' practice of interpreting the intercept of a regression of this kind as a truly fixed cost, then this regression implies that fixed costs of almost \$16 billion are "hidden" in cost components that should be primarily or entirely variable.

**Figure 7. Regression of total attributable and inframarginal costs on weighted mail volume**

	Coefficient	Standard Error	T-statistic	p-value
Intercept (\$ 000)	15,943,793	1,511,603	10.55	<0.001
Slope	0.953	0.033	28.61	<0.001
Number of Observations	8			
Adjusted R Square	0.992			

Source: Author's calculations

- (72) To be clear, I do not believe that this regression is reliable, and the caveats I gave to Figure 5, also apply here. However here we have the additional problem that the regression specification may be incorrect due to the presence of inframarginal costs, which implies curvature of the cost function. While more appropriate statistical models applied to a sufficiently large amount of historical data might be able to tease out the curvature in the cost function in the vicinity of the observed data, any attempt to estimate fixed or inframarginal costs from such a regression will inevitably rely on extrapolation of that curvature to levels of output not observed in the historical data, unless historical volumes tend to zero. If actual curvature at levels of output approaching zero cannot be measured directly, then the total amount of volume-variable and inframarginal costs derived from the data is inevitably based more on assumptions than evidence.

## V. Implications for UPS Proposals One and Two

- (73) It should be clear from the preceding analysis that Dr. Neels has conducted a very one-sided analysis that could only find “hidden variable costs,” and that his analysis cannot be viewed as an impartial inquiry into the question he claims to address, namely “whether and to what extent the actual changes in Postal Service costs that have occurred in recent years are consistent with assumptions underlying Postal Service costing procedures about which of its costs are fixed.” Any attempt to answer that

question necessarily would have to examine all costs, including those costs currently categorized as variable by the Postal Service costing procedures. Dr. Neels made no attempt to do so. When I applied Dr. Neels' method to attributable costs the results suggested, if anything, that the degree of cost variability in Postal Service data currently is overstated rather than understated.

- (74) Furthermore, his statistical methods are unreliable for a variety of reasons, primarily the dependence on very small amounts of data, the strong unstated assumptions implicit in his calculations, and a complete lack of attention to possible confounding influences on costs. Hence, Dr. Neels' methodology cannot be viewed as a reliable method for determining the presence or magnitude of alleged "hidden variable costs."
- (75) However even if Dr. Neels' methodology were free from the problems mentioned already, it cannot avoid the inability of the available data to provide reliable evidence on what costs would be at much lower levels of output than have actually been observed in the data. It is an unescapable fact that economic fixed costs are those that must be incurred even at very low levels of output, and there is no reliable way to estimate those through calculation if low levels of output have not been observed.
- (76) It may be possible to estimate volume variable costs reliably in some cases, since these are defined with respect to marginal costs at current levels of output. Doing so would require more reliable statistical models than the ones put forward by Dr. Neels. However, the problem of distinguishing fixed from variable costs will be especially acute if the Commission adopts UPS Proposal One, since that would require distinguishing all variable costs, including inframarginal costs, from fixed costs. As we have seen it is impossible to reliably distinguish inframarginal from fixed costs using empirical methods if output never tends to zero in the available data. Any attempt to do so will rest on extrapolation using assumed and unverifiable functional forms for the cost function.
- (77) In conclusion, I find that Dr. Neels' analysis does not provide reliable support for adopting UPS Proposal Two. Furthermore, UPS Proposal One cannot reliably be



implemented because it is not possible to reliably distinguish inframarginal from fixed costs by empirical analysis if historical volumes have not approached zero.

VERIFICATION

I, T. Scott Thompson, declare under penalty of perjury that the foregoing is true and correct. Executed on January 25, 2016.

A handwritten signature in cursive script that reads "T. Scott Thompson". The signature is written in black ink and is positioned above a solid horizontal line that spans the width of the signature.

## Appendix A. Curriculum vitae of T. Scott Thompson

### A.1. Summary of experience

Dr. T. Scott Thompson specializes in antitrust analysis of alleged anticompetitive conduct. He has significant methodological expertise and extensive experience using economic models and empirical techniques to assess and quantify predicted effects of proposed mergers, agreements, and single-firm conduct.

Dr. Thompson has an extensive background providing antitrust analysis in support of expert testimony and enforcement decisions. Since joining Bates White he has represented clients before the Federal Trade Commission and the Antitrust Division of the US Department of Justice, and has worked often with clients and testifying experts on matters in litigation.

Prior to joining Bates White, he served as staff economist and the Assistant Chief of the Economic Regulatory Section of the Antitrust Division. In that role, Dr. Thompson conducted or supervised the agency's economic analysis in numerous antitrust investigations in a wide variety of industries including computer software, healthcare, health insurance, investment products, payment systems, financial services, and medical technology. Dr. Thompson has extensive experience in econometrics, simulation, survey design and analysis, analysis of vertical and horizontal restraints, and merger analysis.

Prior to joining the Antitrust Division, Dr. Thompson taught and conducted research in the field of econometrics as Assistant Professor at the University of Minnesota. Over the course of his career, Dr. Thompson has contributed to the academic literature on market definition and market power, two-sided markets, theoretical econometrics, and international trade. He authored parts of the ABA Section of Antitrust Law's treatise *Econometrics* (2005).

### A.2. Education

- PhD, Economics, University of Wisconsin

- MS, Economics, University of Wisconsin
- AB, International Relations, Stanford University

### **A.3. Professional employment history**

- 2006 to present: Partner at Bates White Economic Consulting, Washington DC
- 2003–2006: US Department of Justice, Assistant Chief, Economic Regulatory Section, Antitrust Division
- 1995–2003: US Department of Justice, Economist, Economic Analysis Group, Antitrust Division
- 1994–1995: University of Wisconsin-Madison, Visiting Assistant Professor, Department of Economics
- 1987–1995: University of Minnesota, Instructor and Assistant Professor, Department of Economics
- 1981–1987: University of Wisconsin-Madison, Graduate Assistant and Teaching Assistant, Department of Economics

### **A.4. Selected monopolization and cartel experience**

- Supported expert preparing a declaration filed with the FCC as an exhibit to a petition by T-Mobile USA requesting an expedited declaratory ruling. The declaration analyzed the possible incentives for a mobile wireless network operator to raise rival costs for wholesale data roaming services, and analyzed several pricing benchmarks that the FCC might consider in resolving disputes about whether contract terms for roaming services meet the ‘commercially reasonable’ standard.
- Retained to testify on economic damages on behalf of American Specialty Health, Inc. (ASH) in its exclusive dealing suit against Healthways, Inc. The two companies compete to administer fitness benefits for retirees on behalf of Medicare Advantage health plans. The parties ultimately reached a settlement in which Healthways “agreed to waive the

exclusivity provisions and other provisions contained in contracts with certain participating locations.”

- Provided liability and damages analysis for DuPont in its litigation against Monsanto regarding alleged antitrust and intellectual property violations. Monsanto originally sued DuPont and its Pioneer subsidiary for infringing Monsanto’s Roundup Ready soybean patent. DuPont countersued, accusing Monsanto of antitrust violations and of fraudulently obtaining the patent. The parties agreed to dismiss antitrust and patent lawsuits filed against each other as part of a broader licensing agreement reached between the two agricultural biotechnology giants.
- In two matters, *American Airlines v. Sabre* and *American Airlines v. Travelport*, led the team providing support for expert testimony on damages on behalf of American Airlines. The suits, filed in both state and federal courts in Texas, alleged anticompetitive conduct by Sabre and Travelport in the US market for airline ticket booking services. Claims asserted under both the Sherman Act and the Texas Free Enterprise and Antitrust Act alleged that defendants intended to deter American Airlines from using its “direct connect” technology to compete with the defendants’ global distribution services. After one week of trial, American and Sabre settled their disputes. A settlement with Travelport followed soon thereafter.
- On behalf of DuPont, provided economic analysis and expert testimony in a monopolization case related to sales of para-aramid fiber (e.g., Kevlar) in the United States. Kolon, a para-aramid supplier, alleged that the use of certain supply agreements between DuPont and some of its customers was illegal exclusionary conduct under Section 2 of the Sherman Act. Provided expert testimony showing that DuPont is not a monopolist in para-aramid fiber and the supply agreements at issue are not detrimental to competition. DuPont was granted summary judgment in its favor and Kolon Industries’ antitrust claims were dismissed with prejudice.
- Supported multiple testifying experts retained by counsel for Advanced Micro Devices (AMD) in litigation against Intel, Inc., alleging illegal conduct to maintain a monopoly. Led teams working on issues of market definition, monopoly power, and consumer harm. Led the damages expert support team in the rebuttal phase. Assisted with

deposition preparation. Before the case was brought to trial, AMD and Intel agreed to a \$1.25 billion settlement that included restrictions on certain business practices.

- Supported multiple testifying experts on behalf of direct and indirect plaintiffs in *In re Dynamic Random Access Memory (DRAM) Antitrust Litigation*. Served as the lead econometrician and worked closely with the liability expert to write affirmative and rebuttal expert reports and prepare for deposition. Collaborated with counsel throughout the discovery process in preparing interrogatories, document requests, and drafting deposition questions on core economic issues.
- Worked with an expert in the consumer credit scoring business to analyze market definition and competitive effects including the evaluation of potential efficiencies in a matter alleging exclusionary conduct.

## **A.5. Selected merger experience**

- On behalf of construction material manufacturers Holcim Ltd. and Lafarge SA, provided economic analysis of the likely competitive effects of the proposed \$25 billion merger in markets for cement, ready-mix concrete and construction aggregates in North America, analyzed various divestiture scenarios, and provided ongoing support to attorneys for the parties throughout the regulatory approval process. The analysis was presented in two written submissions to the FTC and two written submissions to the Canadian Bureau of Competition (CBC). After almost one year of review, the FTC and CBC approved the merger, pending certain asset divestitures.
- Conducted detailed economic analysis on behalf of Eli Lilly in connection with its \$5.4 billion acquisition of Novartis Animal Health. Both firms were active in developing and marketing animal health products, including medications used to treat pets and livestock. Bates White assessed overlaps in several areas, and presented results of its analysis to the FTC. The FTC approved the merger after an eight month investigation, with divestiture required in one product area, canine parasiticides.
- Worked on behalf of Dr. Oetker to analyze the competitive effects of its proposed acquisition of McCain Foods' North American frozen pizza business. Submitted

analysis to the Competition Bureau of Canada, who cleared the acquisition without the issuance of a supplemental information request.

- Supported Telefónica in its recent takeover of E-Plus in Germany. Studied the relationship between concentration and price levels in different European mobile markets.
- Retained by a cable TV company to research the effects of television station blackouts on television viewing patterns and cable subscriber turnover, and to evaluate the effects of mergers of local broadcasters on retransmission consent rates.
- Retained to testify on statistical issues in the matter *Federal Trade Commission v. St. Luke's Health System, Ltd.*
- Provided economic analysis and expert support for the Competition Bureau of Canada's evaluation of a proposed merger of equities exchanges and related entities, including the Toronto Stock Exchange.
- Provided economic analysis of AT&T's proposed acquisition of T-Mobile, which raised both horizontal and vertical concerns.
- On behalf of the Canadian Competition Bureau, addressed concerns about possible effects of BHP Billiton's proposed acquisition of Potash Corporation of Saskatchewan. Analyzed market definition, merger efficiencies, and possible unilateral and coordinated effects on competition.
- Worked on behalf of a supply chain logistics company with concerns about foreclosure effects from a proposed vertical merger. Assisted client with presentations to the Federal Trade Commission.
- Conducted economic analysis on behalf of a video programming distributor about vertical foreclosure issues and other possible effects arising from the merger of Comcast and NBC Universal. Assisted the client in meetings with Department of Justice.
- Worked with an academic affiliate on behalf of Dr. Oetker Brasil to provide analysis of its concerns about issues arising from the merger of Sadia and Perdigão to form Brasil Foods. Drafted a white paper for Brazilian competition authorities evaluating claims

about likely effects of the merger on markets for frozen pizza, and possible vertical foreclosure issues in frozen food distribution in Brazil.

- Provided economic consulting support to Delta Air Lines and Northwest Airlines in connection with their proposed merger under investigation by the Department of Justice (DOJ). Identified antitrust risks, analyzed price effects, and developed a retrospective merger analysis for the airline industry.
- Supervised the analysis presented to the FTC on the antitrust implications of The Great Atlantic & Pacific Tea Company's (A&P) proposed acquisition of Pathmark Stores, Inc. on behalf of A&P. Analysis considered the impact of the entry and exit of nearby supermarkets, grocery stores, mass merchandisers, clubs, and other food retailers on prices, margins, and sales. Provided significant assistance to attorneys in responding to second request from the FTC. The FTC ultimately allowed A&P to acquire Pathmark, requiring Pathmark to divest only six of its 141 stores.
- Served as consulting expert and performed market definition and market share analyses on behalf of a hospital system considering a proposed merger. Analysis also considered the effect of various alternative merger scenarios and what effect, if any, they might have on market concentration in the relevant geographic area. Our findings helped the hospital system with its decision not to pursue a merger at this time.
- Supervised the analysis presented to the FTC on behalf of a leading provider of pharmaceutical benefits management services in connection with its proposed acquisition of a competitor. Assisted with response to second request and presented analysis of bid data on likely competitive impact in multiple customer segments.
- Provided a client in the hospital industry with antitrust and industry expertise to assist it and DOJ in investigating alleged anticompetitive conduct by competing firms. Investigations involve complex issues of horizontal and vertical market foreclosure.
- Worked extensively with attorneys and testifying expert in *Federal Trade Commission v. Western Refining*. Directed econometric analysis to support expert report, deposition, and trial testimony regarding market definition and likely competitive effects of a merger between two refiners of light petroleum products.



- Worked on analysis related to DOJ's investigation of Monsanto's proposed acquisition of Delta and Pine Land that raised both horizontal and vertical concerns in the agricultural biotechnology industry. Supervised independent research and data analysis and drafted presentations made to DOJ.
- Appeared before the Federal Trade Commission on behalf of Batesville Casket Company, a leading firm in the death care industry, in connection with a merger that raised both horizontal and vertical concerns. Presented statistical analysis of natural experiments and previous mergers. FTC's second request investigation was closed without any divestitures being required.
- On behalf of a leading distributor of wine and spirits, analyzed likely effects of a horizontal merger reviewed by the Federal Trade Commission and state authorities. The analysis included a retrospective merger analysis and empirical analysis of other natural experiments.
- Provided expert support in connection with the DOJ's investigation of the CME/CBOT merger, including empirical analyses of candidate competitive effects theories.

## **A.6. Selected Department of Justice experience**

- Developed strategy, performed case analysis, assisted with depositions, and reviewed expert reports in *United States v. Dentsply International, Inc.* Worked extensively with economic experts on empirical analysis and a survey design and analysis. Worked with economic expert to refine and evaluate econometric models used to estimate price and quantity effects of exclusive dealing.
- Performed case analysis in *United States and Plaintiff States v. EchoStar Communications Corp.*, which challenged the proposed merger of satellite television providers DirecTV and Dish Network, the only two nationwide providers of multichannel video programming delivery (MVPD) services at the time. Worked on evaluation of defendant econometric model to assess likelihood of consumer harm with full accounting for claimed cost savings and other efficiencies, and projected quality improvements.

- Developed strategy, performed case analysis, assisted with depositions, and reviewed expert reports in *United States v. Visa USA, Inc.*, a monopolization matter.
- Assumed primary responsibility for financial market data analysis, and shared responsibility for economic analysis for the US Department of Justice investigation leading to filing and settlement of the landmark antitrust case *United States v. Alex. Brown & Sons*. As a result of this litigation, 24 major NASDAQ securities firms were charged with practices leading to inflated stock transaction fees.
- Worked closely with economic experts and officials at the Securities and Exchange Commission in *United States v. American Stock Exchange, LLC*. Performed econometric analysis quantifying increased options trading costs arising from illegal agreements between the options exchanges. Final resolution required the options exchanges to cease anticompetitive conduct and to restructure the industry to increase competition.
- Worked extensively with attorneys and economic experts in *United States v. First Data Corp.* Provided support for depositions of opposing experts.
- Conducted demand and merger simulation modeling and analysis involving the extensive use of scanner data and the evaluation of survey data in multiple merger matters involving consumer products.
- Analyzed the deficiencies in scanner data and identified additional data sources to address incomplete coverage of scanner data in a case involving the merger of two leading cosmetic companies.
- Worked with an expert to develop and execute consumer surveys used to assess demand, analyze and critique surveys, and perform demand modeling in *United States and the State of Colorado v. Vail Resorts, Inc.* Analysis included extensive revisions and extensions of econometric models.
- Analyzed scanner data, performed demand estimation and modeling, and performed merger effects analysis and merger simulation modeling in *United States v. Georgia-Pacific Corp.* Also considered efficiency arguments in the case and prepared to provide expert testimony; case settled prior to trial.

- Analyzed scanner data, performed demand estimation and modeling, and performed merger effects analysis and merger simulation modeling in *United States v. Kimberly-Clark Corp.*
- Prepared as potential testifying expert in *United States v. Primestar, Inc.* Prepared econometric estimation for rebuttal of economic experts. Modeled and analyzed penetration rates.
- Provided case analysis, conducted interviews, assisted in preparation of expert reports, assisted in depositions and trial preparations and conduct of the trial in *United States v. Long Island Jewish Medical Center.*

## A.7. Publications

- Thompson, T. Scott. “ACA Exchange Premiums and Hospital Concentration in California.” *ABA Antitrust Health Care Chronicle* 28, no. 1 (2015): 27–34.
- Rozanski, George A. and T. Scott Thompson. “Issues in the Analysis of Buyer Power in Agricultural Markets.” *ABA Antitrust Law Section* (March 2011).
- Thompson, T. Scott. “Out-of-network involuntary medical care: An analysis of emergency care provisions of the Patient Protection and Affordable Care Act.” White paper for America’s Health Insurance Plans, August 2010.  
<http://www.bateswhite.com/insight.php?NewsID=113>.
- Emch, Eric R. and T. Scott Thompson. “Market Definition and Market Power in Payment Card Networks.” *Review of Network Economics* 5, no. 1 (2006): 45–60.
- Rozanski, George A. and T. Scott Thompson. “Use of Econometrics at the U.S. Department of Justice.” In *Econometrics: Legal, Practical, and Technical Issues*, edited by the ABA Section of Antitrust Law, 131–65. Chicago: ABA Publishing, 2005.
- Ichimura, Hidehiko and T. Scott Thompson. “Maximum Likelihood Estimation of a Binary Choice Model with Random Coefficients of Unknown Distribution.” *Journal of Econometrics* 86, no. 2 (1998): 269–95.

- Thompson, T. Scott. “Some Efficiency Bounds for Semiparametric Discrete Choice Models.” *Journal of Econometrics* 58, nos. 1–2 (1993): 257–74.
- Thompson, T. Scott. “Equivalence of Direct, Indirect, and Slope Estimators of Average Derivatives: A Comment.” In *Nonparametric and Semiparametric Methods in Econometrics and Statistics*, edited by Barnett, William A., James Powell, and George Tauchen, 119–26. New York: Cambridge University Press, 1991.
- Manski, Charles F. and T. Scott Thompson. “Estimation of Best Predictors of Binary Response.” *Journal of Econometrics* 40, no. 1 (1989): 97–123.
- Manski, Charles F. and T. Scott Thompson. “Operational Characteristics of Maximum Score Estimation.” *Journal of Econometrics* 32, no. 1 (1986): 85–108.
- Baldwin, Robert E. and T. Scott Thompson. “Responding to Trade-Distorting Policies of Other Countries.” *American Economic Review* 74, no. 2 (1984) 271–6.
- Ginsberg, Paul B., Lawrence A. Wilson, and T. Scott Thompson. “The CBO Hospital Cost Containment Model: A Technical Analysis.” Congressional Budget Office, US Congress, Washington, DC, 1981.

## A.8. Selected speaking engagements

- “Counseling clients on exclusionary conduct: lessons from *AMD v. Intel*.” Presentation to the Antitrust Section, New York State Bar Association. March 2011.
- “Antitrust activity in card-based payment systems: causes and consequences.” Invited presenter, Federal Reserve Bank of New York and the Review of Network Economics. September 2005.
- “Public workshop on estimating the price effects of mergers and concentration in the petroleum industry: an evaluation of recent learning.” Invited panelist, Federal Trade Commission. January 2005.
- Joint FTC/DOJ hearings on health care and competition law and policy. Panel moderator. April 2003.

- Joint meeting of European community and US Antitrust Agency economists on methodological aspects of recent enforcement activities. Case presentation. October 2004.
- Economist training session on GMM estimation. US Department of Justice Antitrust Division and Federal Trade Commission Bureau of Economics. December 2001.
- Attorney training workshop on elementary econometrics. US Department of Justice Antitrust Division. March 2001.
- Department of Economics, University of British Columbia, Vancouver. Seminar presentation. February 1994.
- Department of Statistics, North Carolina State University. Seminar presentation. June 1994.
- Joint statistical meetings, American Statistical Association. Paper presentation. August 1994.
- Department of Economics, University of Wisconsin-Madison. Seminar presentation. December 1994.
- NSF conference on semi- and non-parametric econometrics. Yale University. April 1993.
- Department of Economics, University of Chicago. Workshop presentation. April 1993.
- North American summer meetings of the Econometric Society. Paper presentation. June 1992.
- Research Triangle Econometrics workshop. Workshop presentation. Duke University. Fall 1991.
- CORE conference on discrete choice modeling. Invited paper presentation. Université Catholique de Louvain. October 1990.
- CORE econometrics workshop. Seminar presentation. Université Catholique de Louvain. October 1990.

## A.9. Honors and awards

- Assistant Attorney General’s Distinguished Service Award, US Department of Justice, Antitrust Division, 2001.
- University of Minnesota Supercomputer Institute Computer Resources Grant. “A Resampling Statistical Test for Normality in the Random Coefficients Model of Binary Choice,” 1993.
- University of Minnesota Supercomputer Institute Computer Resources Grant. “Algorithms for Computation of Semiparametric Discrete Choice Estimators,” 1993.
- University of Minnesota Supercomputer Institute Computer Resources Grant. “Monte Carlo Evaluation of Statistical Methods for Random Coefficient Models” (with Hidehiko Ichimura), 1992.
- National Science Foundation Grant, 1991–1992.
- University of Minnesota Graduate School Summer Research Fellowship, 1989.

## A.10. Referee service

- Econometric Reviews
- Econometric Theory
- Econometrica
- International Economic Review
- Journal of Business and Economic Statistics
- Journal of Econometrics
- Journal of Human Resources
- Journal of the American Statistical Association
- Journal of the Japanese and International Economies
- Proceedings of the Fifth International Symposium on Economic Theory and Econometrics

- National Science Foundation Grant Reviews