

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

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POSTAL RATE COMMISSION  
OFFICE OF THE SECRETARY

POSTAL RATE AND FEE CHANGES, 2000

Docket No. R2000-1

RESPONSE OF UNITED STATES POSTAL SERVICE  
WITNESS BOZZO TO INTERROGATORIES OF  
THE OFFICE OF THE CONSUMER ADVOCATE  
(OCA/USPS-T15-1-20)

The United States Postal Service hereby provides the responses of witness Bozzo to the following interrogatories of the Office of the Consumer Advocate: OCA/USPS-T15-1-20, filed on February 4, 2000.

Each interrogatory is stated verbatim and is followed by the response.  
Respectfully submitted,

UNITED STATES POSTAL SERVICE

By its attorneys:

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February 18, 2000

**Response of United States Postal Service Witness Bozzo  
to Interrogatories of the Office of the Consumer Advocate**

OCA/USPS-T-15-1. USPS-LR-I-107 presents the programs and substantiation for your econometric work. You have provided a variety of files and comments in printed as well as electronic form. All of the analysis programs appear to be in TSP form.

- (a) Please indicate why you chose TSP as the programming language in place of SAS or, alternatively, RATS, SYSTAT, STATA, or SPSS.
- (b) Substantial analysis is available in the published literature on the computational and theoretical accuracy of SAS programs. Do you have such independent verification for TSP? If so, please provide it.

OCA/USPS-T-15-1 Response.

- a. TSP is a well-known, sophisticated econometrics research package. See, e.g., Julian Silk, "TSP 4.4: A Review," *Journal of Applied Econometrics*, Vol. 12, pages 445-453 (1997). TSP has a long history, originating with its initial development in the late 1960s by the noted economist Robert Hall. See Ernst R. Berndt, *The Practice of Econometrics: Classic and Contemporary* (Addison Wesley, 1991) at page 246. Several commercial econometrics packages are descended from Hall's work (see Berndt, op. cit., at page 15). See the response to part (b) of this interrogatory for discussion of TSP's accuracy.

TSP has been recognized for its comprehensive panel data estimation procedure, which I use in the programs provided in LR-I-107. See Jeffrey K. MacKie-Mason, "Econometric Software: A User's View," *Journal of Economic Perspectives*, Fall 1992, at page 183. The TSP PANEL command automatically estimates all of the contending estimators (fixed- and random-effects, pooled OLS, and between) from Docket No. R97-1 along with specification test statistics needed to discriminate

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among the estimators, considerably simplifying the overall programming effort relative to that required by packages with less comprehensive panel data facilities.

It is my understanding that SAS has some noteworthy limitations for panel data analysis. According to SAS technical support information, as of SAS Release 6.12, PROC TSCSREG (the SAS panel estimation procedure) cannot compute residuals without an additional DATA step and related programming, which significantly reduces its utility for estimating the fixed-effects model with an autocorrelation adjustment. In versions prior to Release 6.12, PROC TSCSREG could not be run on unbalanced panel data and did not produce R-squared or other goodness-of-fit statistics.

Finally, TSP is fast, relatively inexpensive (less than \$800 for the current shipping PC version 4.5), and is available for a range of computer operating systems.

- b. I do not believe the accuracy of any statistical software package should be taken for granted. Studies exist that document computational inaccuracies in certain SAS routines. See, e.g., B. D. McCullough, "Assessing the Reliability of Statistical Software: Part II," *The American Statistician*, May 1999, at pages 149-159. Extensive computational accuracy benchmarks for TSP are available from the program's authors, using sources such as the National Institute of Standards and Technology's Statistical Reference Datasets archive. (The benchmarks are available on the internet at

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<http://www.tspintl.com/products/tsp/benchmarks/index.htm>.) TSP fared well in a recent published comparison with EViews, LIMDEP and SHAZAM. See B. D. McCullough, "Econometric Software Reliability: EViews, LIMDEP, SHAZAM, and TSP," *Journal of Applied Econometrics*, Vol. 14, at pages 191-202 (1999). Note that I use the double precision storage option in my TSP programs (implemented via the "options double" statement in the first line).

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-2. Please provide SAS versions in printed as well as electronic form of the TSP programs used in your work.**

**OCA/USPS-T-15-2 Response.**

It is my understanding that the TSP code I used for my econometric analysis could be translated into SAS code by those who prefer to use SAS rather than TSP. In particular, I understand that PROC TSCSREG in SAS/ETS or PROC MIXED in SAS/STAT could be used to compute the fixed effects estimator for my labor demand models, which I implemented with the TSP PANEL command. It is also my understanding that significant additional programming would be required to implement all of the relevant features of the TSP PANEL command in SAS code; see the response to OCA/USPS-T-15-1(a). I am not a SAS programmer and the programming details of the translation are beyond the scope of my testimony.

For further information on SAS PROC TSCSREG, see *SAS/ETS Software: Changes and Enhancements for Release 6.12* (SAS Institute, Inc., March 1997). For further information on SAS PROC MIXED, see *SAS/STAT Software: Changes and Enhancements through Release 6.12* (SAS Institute, Inc., March 1997). For further information on the TSP PANEL command, see *Time Series Processor Version 4.4 Reference Manual* by Bronwyn H. Hall and Clint Cummins (TSP International, 1998).

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-3.** You have provided an Excel database of the data input to your programs in Library Reference USPS-L-I-107 [sic]. You subsequently scrub the data in various TSP programs. Please provide an Excel database and documentation of the scrubbed data set as developed in your TSP programs.

**OCA/USPS-T-15-3 Response.**

Please see my testimony, USPS-T-15 at pages 108-115, and LR-I-107 at pages 4 to 5 and 41 to 42, for descriptions and documentation of the sample selection procedures I applied. There is no separate "scrubbed" database. In LR-I-186, I will provide a spreadsheet, sampsel.xls, reporting the dummy variables ( $f_{nn\_not}$ ), where  $nn$  denotes the operation group number) indicating the regression sample for each operation group reported in USPS-T-15. The dummy variables have a value of one for included observations and zero for excluded observations.

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**OCA/USPS-T-15-4. Please refer to page 20 of your testimony, lines 14-15, in which you state, "Having concluded that some selection criteria were warranted...."**

- (a) Please explain the basis for this statement.**
- (b) Did you have a statistical test to substantiate the statement? If so, please provide the relevant information.**

**OCA/USPS-T-15-4 Response.**

- a. Please see my testimony, USPS-T-15, at page 20, lines 3-13.**
- b. The quoted statement was not based upon the results of a statistical test.**

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**OCA/USPS-T-15-5. Please refer to page 20 of your testimony, lines 1-3, in which you state that, "The absence of evidence that Dr. Bradley's scrubs biased his estimated elasticities was not, however, sufficient to commend their continued use in my study."**

- (a) If you are verifying that Dr. Bradley was correct in his approach, do you have a statistical measure of how much better your approach is?**
- (b) If you are verifying that Dr. Bradley was wrong in his approach, please explain further.**

**OCA/USPS-T-15-5 Response.**

- a. I believe the quoted statement as written indicates that I am not "verifying that Dr. Bradley was correct in his approach." Please see also USPS-T-15 at page 21, lines 15-16.**
- b. Please see USPS-T-15 at pages 94 to 102 (Section VI.D).**



**Response of United States Postal Service Witness Bozzo  
To Interrogatories of the Office of the Consumer Advocate**

**OCA/USPS-T-15-6.** You indicate in your testimony at page 21, lines 16-17, that, "First, I have fewer observations because of the use of quarterly data over a shorter time period...."

- (a)** Please explain why you used quarterly data instead of following the procedures Dr. Bradley used in Docket No. R97-1.
- (b)** Please explain why you chose to use a shorter calendar period of time than Dr. Bradley used in Docket No. R97-1 for your analysis.

**OCA/USPS-T-15-6 Response.**

- a.** Please see my response to MPA/USPS-T-15-7.
- b.** Please note that the time period covered by my data set, PQ2 of FY 1993 to PQ4 of FY1998, overlaps but is not a subset of the time period covered by Dr. Bradley's data set in Docket No. R97-1, PQ1 of FY 1988 to PQ4 of FY 1996. The shorter time interval I chose to use is the net result of adding two recent years (FY 1997 and FY 1998) whose data were unavailable to Dr. Bradley, and not using data prior to PQ2 of FY 1993.

My main motivation for employing data over a shorter time period was the desire to balance the potentially competing aims of efficient estimation and accurate estimation of the labor demand functions. Other things equal, increasing the number of observations by admitting earlier data would reduce the sampling error of the estimates. See also the discussion at USPS-T-15 at page 80, lines 3-9. However, extending the sample period back in time does not hold other things equal. It raises the possibility of introducing non-sampling errors in the estimates to the extent the earlier data are unrepresentative of current operations.

**Response of United States Postal Service Witness Bozzo  
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Particularly insofar as the estimated standard errors of my elasticity estimates are relatively small, I believe that I have struck a reasonable balance between these competing aims.

I also considered two other factors. The composition of Dr. Bradley's data set changed with the addition of MOD2 (PC-MODS) sites in FY 1991; the earlier observations were entirely of MOD1 facilities, which tend to be larger. Using the later data avoids potential problems related to the composition shift. Additionally, the Postal Service's reorganization at the beginning of FY 1993 included a realignment of Finance numbers. Using the post-reorganization data eliminates a need for separate data mapping procedures for the earlier period.

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-7. You state in your testimony at page 21, line 22, "Therefore, I believe the updated sample selection criteria are not 'excessive.' " Do you have a statistical test to substantiate this statement? If so, please provide it.**

**OCA/USPS-T-15-7 Response.**

No, my statement is based on the fact that I developed my sample selection rules to admit some otherwise usable observations that Dr. Bradley's sample selection procedures would have excluded (see USPS-T-15 at page 21, lines 20-21), and on a comparison of Dr. Neels' report of observations "discarded" by Dr. Bradley's sample selection rules (Docket No. R97-1, Tr. 28/15611) to the closest comparable figures on observations remaining after my sample selection rules (see USPS-T-15, page 107, Table 3, "Minimum Obs" column).

**Response of United States Postal Service Witness Bozzo  
To Interrogatories of the Office of the Consumer Advocate**

**OCA/USPS-T-15-8. Please refer to your discussion of the Manual Ratio at pages 23-25 of your testimony. Is it your conclusion that a computed manual ratio would measure the same degree of automation in small, medium, and large MODS sites, and that a computed manual ratio number would be comparable from site to site? Please explain your answer.**

**OCA/USPS-T-15-8 Response.**

As the manual ratio variables measure the proportion (rather than the level) of manual handlings for the appropriate shape of mail, they can provide comparable information on the degree of automation in "small, medium, and large MODS sites." That is, I expect two sites with the same measured manual ratio would tend to employ a similar relative mix of processing technologies, but not necessarily the same scale of operations.

**Response of United States Postal Service Witness Bozzo  
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OCA/USPS-T-15-9. You indicate in your testimony at page 33, lines 2-4, that "The present analysis can be interpreted either in terms of the classical minimum cost function, or a generalized 'non-minimum cost function' with a generally similar structure." A review of standard economic theory indicates that economists derive a variety of marginal relationships in analyzing production, cost, and input factor demand functions. You have empirical data input from a variety of mail processing facilities for a variety of functions. Some Postal mail processing facilities and functions may be operated on a cost minimization basis, and other Postal processing facilities and functions could conceivably be operated inefficiently. As you use data as input to your econometric analyses from all facilities, are your conclusions independent of whether the facilities are cost minimizers?

OCA/USPS-T-15-9 Response.

Yes. See also USPS-T-15 at page 33, lines 5-19.

**Response of United States Postal Service Witness Bozzo  
To Interrogatories of the Office of the Consumer Advocate**

**OCA/USPS-T-15-10.** In your testimony at page 40, lines 10-12, you assert that "...capital and labor variabilities will be identical, in equilibrium, under the assumption that the cost pool-level production (or cost) functions are *homothetic*."

- (a)** Do you have any proof or indication based on actual Postal operations that the functions are in fact homothetic? If so, please explain.
- (b)** You quote Dr. Bradley's mail processing testimony in Docket No. R97-1 extensively; was homotheticity one of his assumptions?
- (c)** Please provide a derivation of your assertion in your testimony at page 40, lines 12-14, that "Homotheticity implies that changing the level of output of the operation will not alter relative factor demands such as the capital /labor ratio, in equilibrium (and other things equal)."
- (d)** What would be the impact of relaxing your assumption on homotheticity?
- (e)** Does one normally assume homotheticity in developing an econometric cost study? If not, under what circumstances is the homotheticity assumption either assumed or not assumed?

**OCA/USPS-T-15-10 Response.**

- a.** No, as the quoted statement indicates, the purpose of that section of my testimony is to describe the economic assumptions underlying the Postal Service's methodology.
- b.** Please note that I do not quote Dr. Bradley's testimony in this context. As far as I am aware, Dr. Bradley made no reference to non-labor costs or related assumptions in his Docket No. R97-1 mail processing testimony.
- c.** The statement follows from the fact that a homothetic production function has a constant marginal rate of technical substitution along any ray from the origin of

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input space. See, e.g., Robert G. Chambers, *Applied Production Analysis* (Cambridge University Press, 1988), page 38.

- d. The labor and capital variabilities would not necessarily be equal.
- e. Given estimated capital demand functions, I believe the homotheticity assumption could be testable. I do not have an estimate of how common the homotheticity assumption is, though I note that some common functional forms such as the CES are intrinsically homothetic, and that Chambers describes homothetic production functions as "[p]erhaps the most important special class of production functions" (Chambers, op. cit., page 37). See also USPS-T-15 at page 40, lines 14-16 and footnote 12.

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-11.** You indicate in your testimony at pages 46-47 that the "manual ratio" variable is a measure of the degree of automation and is an indicator of the site's organization of mailflows in letter and flat sorting operations.

- (a)** Is the manual ratio dependent on the location of the mail processing facility within the network of mail processing facilities?
- (b)** Is the "manual ratio" dependent on the characteristics of the territory which the mail processing facility serves?
- (c)** Is the "manual ratio" dependent on the characteristics of the sorting patterns within the mail processing plant? If your answer is "yes", please explain in detail how the "manual ratio" is dependent on the characteristics of the sorting patterns.
- (d)** Is the "manual ratio" dependent on the amount of equipment in the mail sorting plant?

**OCA/USPS-T-15-11 Response.**

- a.** Conceivably, yes. To the extent network characteristics affect local mailflows and automation usage, they may affect the manual ratio variable.
- b.** See the response to part (a) of this interrogatory.
- c.** By construction, the manual ratio is indicative of the relative amount of automation usage in the "sorting patterns" at a site. I cannot specify additional detail without a more precise definition of "characteristics of the sorting patterns."
- d.** See USPS-T-15 at page 56, line 18, to page 57, line 5.



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**OCA/USPS-T-15-12. You appear to base your analysis on TPF (total pieces fed). Please provide FHP (first handled pieces) and TPH (total pieces handled) for all cases in which you provide TPF, including the relevant Excel spreadsheets.**

**OCA/USPS-T-15-12 Response.**

I use TPF as the output measure in automated and mechanized sorting operations (BCS, OCR, FSM, LSM, and SPBS). In the other operations I use TPH as the output measure (in those operations, TPH and TPF are conceptually identical). See USPS-T-15 at page 51, line 16, to page 52, line 4. Please note that I provide TPH data for all of the operation groups I studied in the reg9398.xls file in LR-I-107. See also USPS-T-15, page 89, at lines 4-5. I will provide the requested FHP data in the Excel spreadsheet file fhp9398.xls in LR-I-186. See also USPS-T-15, page 50, line 22, to page 51, line 6, for a discussion of FHP.

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**OCA/USPS-T-15-13.** You state in your testimony at pages 54-55 that, "The assumption implicit in the Postal Service's method that major changes in operations will not take the form of drastic intra-year changes is not very restrictive, given that most national deployments of new equipment and substantial changes to operations require years to complete." How many years are required for the national deployments and/or other activities to which you refer?

**OCA/USPS-T-15-13 Response.**

The quoted statement does not refer to a specific program or imply a specific length of time to complete a national equipment deployment. However, it is my understanding that major equipment deployments usually take more than one year. See, e.g., USPS-T-10 at page 11, lines 19-29.

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**OCA/USPS-T-15-14.** You state in your testimony at page 55, lines 3-6, that, "Likewise, it is hard to envision rapid and drastic changes in the average work content of the mail subclasses in the absence of correspondingly drastic changes to worksharing discounts and other economic incentives facing mailers." In order to have a basis for the above envisioning, please indicate the length of time after which one might find such changes.

**OCA/USPS-T-15-14 Response.**

The quoted statement does not imply a specific length of time. Note, however, that among the factors potentially affecting mailer behavior, mail classifications and postage rates will often be fixed for the period between omnibus rate cases. Mail classifications and postage rates may or may not change significantly over longer periods of time, depending on the contents of the Postal Service's requests, the Commission's recommended decisions, and/or the actions of the Governors of the Postal Service.

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-15.** Your testimony at page 56, line 9, indicates that the manual ratio should be treated as non-volume-variable. Could the manual ratio depend upon,

- (a) the position of the mail processing facility in the network of mail processing facilities;**
- (b) the internal layout of the mail processing facility;**
- (c) the size of the mail processing facility as measured in TPF; and/or**
- (d) the total TPF in a given operation?**

**OCA/USPS-T-15-15 Response.**

- a. See the response to OCA/USPS-T-15-11(a)**
- b. It depends on the definition of "facility." While building layout issues such as space availability may affect the mix of processing in the plant versus annexes (if any), the manual ratio is developed from REGPO-level data and will thus represent the processing patterns at that level.**
- c. Other things equal, no. See USPS-T-15 at page 145, lines 5-10.**
- d. See USPS-T-15 at page 144, lines 1-4.**

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-16.** You state in your testimony at page 65, lines 13-15, that your choice of a translog functions [sic] is chosen, at least in part, because, "This allows me to place as few mathematical restrictions as possible on the functional form of the underlying cost and production functions."

- (a)** What are the underlying restrictions that you have avoided?
- (b)** What are the underlying restrictions to which your study is subject?
- (c)** Your discussion of the translog function specifically mentions a cost function, but at the bottom of the page in footnote 25 you indicate that you are not pre-supposing a translog cost function. It would appear that your technical point is contradictory to your testimony. Please explain.

**OCA/USPS-T-15-16 Response.**

- a.** See USPS-T-15 at page 65, lines 10-13, where I state, "I chose... the translog functional form for the mail processing labor demand models. The translog [functional form] has general applicability because it provides a second order approximation to a function of arbitrary form." The restrictions I have "avoided" are those associated with the use of a functional form for the labor demand models that does not have the translog's approximation properties.
- b.** The choice of the translog functional form has the restrictions that the labor demand functions cannot be restricted to be globally concave or separable without losing the translog's approximation qualities. See also Robert G. Chambers, *Applied Production Analysis*, page 181.
- c.** In footnote 25, I state that "by specifying translog labor demand functions, I do not presuppose a translog cost function." My testimony does not state that I presuppose a translog cost function. There is no contradiction.

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**OCA/USPS-T-15-17.** In your discussion of translog cost and production functions you have not discussed a derived demand function--the labor demand function. However, the estimation of such a function appears to be the key focus of your testimony. The demand for labor by a firm is generally expressed in terms of the value of the marginal product of labor with quantities being expressed in terms of a wage rate and units of labor.

- (a)** What mathematical restrictions have you put on the function that you are trying to estimate?
- (b)** Does this labor demand function derive from another function, possibly cost and production functions? Please show this derivation, with particular attention to mathematical restrictions and/or assumptions that subsequently may lead to conclusions similar to your conclusions about homotheticity.

**OCA/USPS-T-15-17 Response.**

Your statement that I "have not discussed a derived demand function--the labor demand function" is incorrect. See, e.g., USPS-T-15 at pages 42-44 (Section IV.A., "Volume-variability factors can be obtained from labor demand functions defined at the mail processing operation (cost pool) level"). I also believe it would be more appropriate to say that the usual expression of a firm's labor demand relates "units of labor" (i.e., "real" labor input) to the level of output, the wage, and other variables that appear in the cost function (which results from the marginal analysis equating the value of the marginal product of labor with the wage rate).

- a.** I assume that by "mathematical restrictions... on the function [I am] trying to estimate" you mean restrictions on the parameters of the estimating equations reported in USPS-T-15 at pages 117 and 118. I have not imposed any restrictions on the parameters of the estimating equations.

**Response of United States Postal Service Witness Bozzo  
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- b. Yes, I refer to this relationship in USPS-T-15 at, e.g., page 42, lines 11-15. The mathematical relationship between the cost function and labor demand function is known as Shepard's Lemma, which provides that if the cost function is locally differentiable, the labor demand function is equal to the partial derivative of the cost function with respect to the wage. For a formal proof, see (e.g.) Hal R. Varian, *Microeconomic Analysis*, Second Edition (W. W. Norton, 1984), page 54. Homotheticity is not a necessary condition of Shepard's Lemma.

**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-18. You state in your testimony at page 66, lines 1-3, that, "Another important feature of the translog labor demand function is that it does not restrict the output elasticities (volume-variability factors) to be the same for every site or every observation...." Please state all additional important features of your translog labor demand function that have not been previously highlighted or stated.**

**OCA/USPS-T-15-18 Response.**

**Regarding my use of the term "another" in the quoted statement, there is not a "missing" important feature that has not been previously mentioned. The "other" advantage of the use of the translog function to which the quoted statement refers is the second-order approximation property discussed in USPS-T-15 at page 65, lines 10-20.**



**Response of United States Postal Service Witness Bozzo  
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**OCA/USPS-T-15-19.** In reference to non-MODS operations, in your testimony at page 134, lines 17-19, you state, "I expect that the Postal Service will be able to provide quantitative evidence to bolster the quantitative analysis for some of these operations in the future." Given your knowledge of the Postal Service's work in this area, when will this evidence be available?

**OCA/USPS-T-15-19 Response.**

The Postal Service already collects data that may eventually prove usable for estimation of volume-variability factors for some of the operations referenced in the quoted statement (see USPS-T-15 at page 134, lines 19-20). I am unable to estimate when the required analysis and related background work would commence or be completed.

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To Interrogatories of the Office of the Consumer Advocate**

**OCA/USPS-T-15-20.** On page 135, line 7, of your prepared testimony, you indicate that time and resource constraints prevented the Postal Service from updating witness Bradley's BMC models presented in Docket No. R97-1.

- (a)** How much time, as measured in person years, did you estimate that such an effort would require?
- (b)** For purposes of comparison, how much time was spent in the development of the current analysis that you are presenting in this case, as measured in person years?

**OCA/USPS-T-15-20 Response.**

- a.** As a rough estimate, an update of Dr. Bradley's models that did not require the development of new data systems might require one to two person-years' work. If it were determined that a source of workload data other than PIRS were required, an indeterminate but very large additional amount of labor would be needed.
- b.** The analysis presented in USPS-T-15 involved approximately five person-years' work.

## DECLARATION

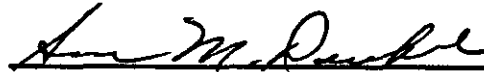
I, A. Thomas Bozzo, declare under penalty of perjury that the foregoing answers are true and correct, to the best of my knowledge, information, and belief.

A. Thomas Bozzo

Dated: 2/18/00

## CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon all participants of record in this proceeding in accordance with section 12 of the Rules of Practice.

A handwritten signature in cursive script, appearing to read "Susan M. Duchek", is written over a horizontal line.

Susan M. Duchek

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