BEFORE THE
POSTAL RATE COMMISSION
WASHINGTON DC 20268-0001

POSTAL RATE AND FEE CHANGES, 2000)	Docket No. R2000-1

SUPPLEMENTAL TESTIMONY
OF
STUART W. ELLIOTT
ON BEHALF OF
MAGAZINE PUBLISHERS OF AMERICA, INC.
ALLIANCE OF NONPROFIT MAILERS
AMERICAN BUSINESS MEDIA
COALITION OF RELIGIOUS PRESS ASSOCIATIONS
DOW JONES & COMPANY, INC.
THE McGRAW-HILL COMPANIES, INC.
NATIONAL NEWSPAPER ASSOCIATION
TIME WARNER INC.

Table of Contents

2   My name is Stuart W. Elliott. I am a Senior Analyst at Project

3   Performance Corporation (PPC), a consulting firm based in McLean, VA. PPC

4   provides management, information technology, and environmental consulting

5   services to private and public sector clients.

6   I attended Columbia University, where I received a B.A. in Economics,

7   summa cum laude, in 1985. I also attended the Massachusetts Institute of

8   Technology, where I received a Ph.D. in Economics in 1992. In graduate school,

9   my major fields were labor economics and industrial organization. I received

10   postdoctoral training in experimental psychology at Carnegie Mellon University

11   from 1991 until 1994.

12   Following my formal education, I was a Research Fellow at Carnegie

13   Mellon University from 1994 until 1999, where I studied the impact of computers

14   on jobs and productivity. During the 1997-98 academic year, I was also a visiting

15   scholar at the Russell Sage Foundation. I joined PPC in 1999, where I have

16   worked primarily on analysis related to postal economics.

17   **1. Purpose and Scope of Testimony**

18   The purpose of this testimony is to respond to the Fourth Notice of Inquiry

19   (August 2, 2000) (NOI 4), which asks for investigation of a set of variability

20   models that are similar to those presented by witness Bozzo but that differ by

21   including time-specific fixed effects rather than site-specific fixed effects. In my

22   response, I present a more general model that includes both time-specific and

23   site-specific fixed effects. My analysis of this model shows that the time-specific

1   fixed effects add little explanatory power and that their omission from witness

2   Bozzo's analysis is of no practical significance.

3   **2. It is straightforward to test a model that includes both site-specific and**
4   **time-specific fixed effects. Models A and B from NOI 4 are both nested**
5   **within this more general model.**
6
7   NOI 4 requests the investigation of mail processing variability models that

8   are generally similar to witness Bozzo's preferred model except that they have

9   time-specific fixed effects rather than site-specific fixed effects. Furthermore,

10   NOI 4 seems to express an interest in the investigation of more general models,

11   both in its questions about nesting relationships between different models and in

12   its reference to a chart from Docket No. R97-1 (Tr. 28/15776) that shows some of

13   those relationships.

14   In response, I have chosen to investigate the time-specific fixed effects

15   that are the focus of NOI 4 within the context of a more general model that also

16   includes site-specific fixed effects. This avoids the problem of investigating

17   multiple models that are not nested within each other and therefore avoids the

18   resulting confusion suggested in parts (c)-(e) of NOI 4.

19   Using the notation of NOI 4, the more general model that includes both

20   types of fixed effects takes the following form:

21 $$y_{it} = \alpha_i + \alpha_t + x_{it}\beta + \varepsilon_{it}$$

22   where y_{it} represents the logarithm of hours, α_i represents the site-specific fixed

23   effects, α_t represents the time-specific fixed effects, and x_{it} represents all other

24   explanatory variables including the logarithm of volume. This model generalizes

1   from Models A and B of NOI 4 by including both α_i and α_t. In contrast, Model A

2   includes α_i but not α_t, whereas Model B includes α_t but not α_i.

3   The addition of time-specific fixed effects to witness Bozzo's model is

4   straightforward. However, it is not possible to estimate panel data models with

5   two sets of fixed effects with the Time Series Processor (TSP) program used by

6   witness Bozzo, so I estimate the more general model by adding a set of quarter

7   dummy variables. If the model did not already include variables to control for the

8   effects of time, I would have done this by adding a total of 18 quarter dummy

9   variables, reflecting the maximum of 19 quarters of complete data in witness

10   Bozzo's dataset. However, witness Bozzo's model already includes 3 seasonal

11   dummy variables to capture seasonal fluctuations and 2 time-trend variables to

12   capture steady changes over time. As a result, the effect of a full set of 18

13   quarter dummy variables is achieved by the explicit addition of only 13 quarter

14   dummy variables. The remaining 5 quarter dummies are included implicitly as

15   combinations of the 13 included quarter dummies and the 5 time-related

16   variables already included in witness Bozzo's model.

17   No changes to witness Bozzo's model are required to produce this more

18   general model beyond the addition of the 13 quarter dummy variables. Part (a)

19   of NOI 4 suggests that "[a]ny terms used by witness Bozzo that are not needed

20   because of the presence of α_t, such as lagged dependent variables and

21   regressors may be omitted." This statement seems to reflect a belief that the

22   inclusion of time-specific fixed effects will turn the model into a cross-section

23   model, a type of model that often does not include lagged variables. Such a

1   conclusion would be in error. First, the model is not equivalent to a cross-section

2   model, because the coefficients on the other variables (the β) do not vary by

3   time. Second, and more importantly, the omission of lagged variables from

4   cross-section models is usually a necessity, not a virtue: it is done because the

5   necessary lagged data are unavailable. In contrast, in cases when the

6   necessary lagged data are readily available, it does not make sense to ignore

7   them if we believe that people and institutions take time to adjust to changed

8   circumstances.

9   **3. Estimating the more general model on witness Bozzo's data shows that**
10   **the additional time-specific fixed effects of Model B add little explanatory**
11   **power and do not significantly change the volume-variability estimates.**
12

13   To demonstrate the explanatory power of the time-specific fixed effects, I

14   contrast the general model that includes both site-specific and time-specific fixed

15   effects with three nested models: Model A, which includes only site-specific fixed

16   effects; Model B, which includes only time-specific fixed effects; and witness

17   Bozzo's pooled model, which includes neither site-specific nor time-specific fixed

18   effects.

19   I use witness Bozzo's TSP programs directly to obtain the results for

20   Model A and for the pooled model.[1] To estimate the two models that include

21   time-specific fixed effects (the general model and Model B), I make five minor

22   changes to witness Bozzo's TSP programs. The resulting programs and output

23   are included in library reference MPA-LR-15, with the changes numbered NOI4-1

24   through NOI4-5.

---

[1] I use the revised versions of witness Bozzo's TSP programs that were provided in USPS-LR-I-239.

1   Because of time constraints, I focus on the versions of the models that do

2   not include the autocorrelation correction. Without this correction, the models are

3   less efficient than the models estimated by witness Bozzo, but they are still

4   unbiased and consistent. Because of the loss of efficiency, I do not advocate

5   that my variability estimates be used in place of those provided by witness

6   Bozzo. Instead, the aim of my analysis is to show the impact of the time-specific

7   fixed effects discussed in NOI 4.

8   Table 1 provides the Adjusted R-squared measures for the four models for

9   the five largest cost pools estimated by witness Bozzo. It is clear from the table

10   that time-specific fixed effects add only a small amount of explanatory power.

11   Whether the time-specific fixed effects are added to the pooled model to produce

12   Model B or are added to Model A to produce the general model, the table shows

13   that the resulting change in Adjusted R-squared is small and sometimes

14   negative. In contrast, it is clear that site-specific fixed effects add a much larger

15   amount of explanatory power, whether they are added to the pooled model to

16   produce Model A or are added to Model B to produce the general model.

17
18   Table 1: Adjusted R-Squared for Four Variability Models

Model	BCS	FSM	Manual Flats	Manual Letters	SPBS
General Model	0.9832	0.9872	0.9770	0.9803	0.9359
Model A – Site Effects	0.9830	0.9871	0.9770	0.9800	0.9347
Model B – Time Effects	0.9506	0.9556	0.9258	0.9329	0.7240
Pooled Model	0.9505	0.9557	0.9260	0.9328	0.7248

19

20   It is not surprising that the time-specific fixed effects add little explanatory

21   power, since witness Bozzo's model already includes the impact of regular

1   seasonal fluctuations and the impact of a smooth trend over time. These are the

2   primary time-related effects that one would expect to see. The addition of the

3   quarter dummy variables merely allows the model to explain single-quarter

4   shocks to mail processing productivity and deviations from a quadratic time

5   trend.

6   Although the time-specific fixed effects add little explanatory power, they

7   add enough so that Model A is usually rejected in favor of the general model.

8   Using an F test of the restrictions, Model A is rejected in favor of the general

9   model at a significance level of less than 1 percent for all cost pools except

10   Manual Flats. In the case of Manual Flats, the F test has a significance level of

11   19 percent, indicating that Model A cannot be rejected in favor of the general

12   model. The calculations are shown in Attachment 1.

13   All the models without site-specific fixed effects are rejected in favor of the

14   general model. Using an F test, both Model B and the pooled model are rejected

15   in favor of the general model at a significance level of less than 0.01 percent for

16   all five cost pools. This is not surprising, since it merely restates the conclusion

17   shown by the tests performed by witness Bozzo on the model with the

18   autocorrelation correction.

19   Table 2 shows the volume-variability factors that are calculated in USPS-

20   LR-I-239 and MPA-LR-15 for the four models.[2] This table underlines the

21   conclusion from Table 1 that the time-specific fixed effects add little explanatory

22   power. There is very little change in the estimated variabilities when time-

---

[2] The variabilities shown for Model A and the pooled model differ from witness Bozzo's estimates in Tables 6 and 7 and Appendix F of USPS-T-15 because they do not include the correction for autocorrelation.

1 specific fixed effects are added, whether they are added to the pooled model to

2 produce Model B or are added to Model A to produce the general model.

3 Although Model A is usually rejected in favor of the general model, the difference

4 between the variability estimates from these two models is very small. Thus the

5 impact of witness Bozzo's omission of time-specific fixed effects is of no practical

6 significance.

7
8   Table 2: Volume-Variability Factors for Four Models

Model	BCS	FSM	Manual Flats	Manual Letters	SPBS
General Model	0.827	0.645	0.505	0.579	0.683
Model A – Site Effects	0.847	0.643	0.518	0.586	0.670
Model B – Time Effects	1.030	1.036	0.944	0.911	0.873
Pooled Model	1.033	1.036	0.945	0.910	0.872

9

Attachment 1: F Tests of Restrictions to General Model

	Ref	BCS	FSM	Manual Flats	Manual Letters	SPBS
Number of Observations	[1]	5,406	4,373	4,891	5,512	1,584
Number of Restrictions for Model A	[2]	13	13	13	13	13
Number of Restrictions for Model B	[3]	297	235	277	299	94
Number of Restrictions for Pooled Model	[4]	310	248	290	312	107
Degrees of Freedom for General Model	[5]	5,057	4,086	4,562	5,161	1,445
Sum of Squared Residuals for General Model	[6]	118.39	37.66	94.49	102.07	31.66
Sum of Squared Residuals for Model A	[7]	120.30	37.93	94.84	103.89	32.56
Sum of Squared Residuals for Model B	[8]	368.10	137.52	322.92	367.95	145.25
Sum of Squared Residuals for Pooled Model	[9]	370.11	137.84	323.32	369.20	146.09
F Statistic for Restriction to Model A	[10]	6.28	2.25	1.33	7.08	3.17
F Statistic for Restriction to Model B	[11]	35.91	46.10	39.82	44.97	55.16
F Statistic for Restriction to Pooled Model	[12]	34.68	43.82	38.10	43.29	48.81
Significance Level for Restriction to Model A	[13]	0.0000	0.0061	0.1869	0.0000	0.0001
Significance Level for Restriction to Model B	[14]	0.0000	0.0000	0.0000	0.0000	0.0000
Significance Level for Restriction to Pooled Model	[15]	0.0000	0.0000	0.0000	0.0000	0.0000

[1] USPS-LR-I-239 and MPA-LR-15, provided on all runs.
[2] Number of quarter time dummies.
[3] = Number of sites − 1. Number of sites provided on all runs of USPS-LR-I-239 and MPA-LR-15.
[4] = [2] + [3]
[5] = [1] − ([4] + Number of other variables). Number of other variables is 32 for SPBS and 39 for all other cost pools.
[6] MPA-LR-15, "Within" runs without autocorrelation correction.
[7] USPS-LR-I-239, "Within" runs without autocorrelation correction.
[8] MPA-LR-15, "Total" runs without autocorrelation correction.
[9] USPS-LR-I-239, "Total" runs without autocorrelation correction.
[10] = (([7] − [6]) / [6]) * ([5] / [2])
[11] = (([8] − [6]) / [6]) * ([5] / [3])
[12] = (([9] − [6]) / [6]) * ([5] / [4])
[13] F probability distribution of [10] with [2] and [5] degrees of freedom.
[14] F probability distribution of [11] with [3] and [5] degrees of freedom.
[15] F probability distribution of [12] with [4] with [5] degrees of freedom.

CERTIFICATE OF SERVICE

I hereby certify that I have this date served the foregoing document upon all participants of record in this proceeding in accordance with the Commission's Rules of Practice.

James Pierce Myers

Washington DC
August 21, 2000