USPS-T-8

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

POSTAL RATE AND FEE CHANGES, 2000

Docket No. R2000-1

DIRECT TESTIMONY
OF
GERALD L. MUSGRAVE
ON BEHALF OF
THE UNITED STATES POSTAL SERVICE

CONTENTS

DIRECT TESTIMONY
OF
GERALD L. MUSGRAVE

AUTOBIOGRAPHICAL SKETCH

My name is Gerald L. Musgrave. I am an economist and the president of Economics America, Incorporated, a consulting company in Ann Arbor, Michigan. My primary responsibilities are to develop econometric models and economic analyses. I am the Book Review Editor and a general associate editor of *Business Economics*, The Journal of the National Association for Business Economics.

I have a B.A. in economics from California State University, and an M.A. and Ph.D. in economics from Michigan State University. My dissertation was in applied econometrics.

I began my professional career in 1968, teaching senior military officers (Navy captains and Marine full colonels) at the United States Naval Postgraduate School. From 1968 to 1976, I was assistant professor of economics, academic associate, associate professor of administrative sciences and associate professor of economics. My teaching was in the graduate programs in economics, business administration, computer science, and operations research.

During the summers of 1974 and 1975, I was a visiting professor of economics at Michigan State University. In 1976, I accepted an appointment at Stanford University. My research was in the general area of economic models, applied econometrics and computational statistics. I designed and supervised the installation of the computer facility at the Hoover Institution, and was an economic advisor to the

"Age of Uncertainty" television series on National Public Television.

In 1979, I accepted an appointment at the University of Michigan. I was a senior research associate in the Highway Safety Research Institute where I developed quantitative economic analyses of the motor vehicle system. I also taught graduate courses in the Department of Economics, Graduate School of Business, and the Institute of Public Policy Studies.

Since 1983, my full-time occupation has been the president of Economics America, Inc. Our work has generally been in the area of econometric models and analysis of the health care sector.

I have authored, or coauthored over 80 publications in the area of economic analysis. These include articles, monographs, reports and books. One is APL-Stat, A Guide to Computational Statistics with Professor James Ramsey, the former department chairman of NYU. I am on the Board of Academic Advisors, of The National Center for Policy Analysis and the Heartland Institute. I have held several offices in the National Association for Business Economics including chairman of the Health Economics Roundtable of the NABE. I have received awards from the National Association for Business Economics including a 1995 Abramson Award for a publication and in 1992, I was awarded the designation of Fellow, the organization's highest honor.

I am an economic advisor to the American Dental Association. I serve as consultant on econometric methods and economic models in work on postal prices, competition and demand markets of mail streams for the Postal Service. I testified on

behalf of the Postal Service as a rebuttal witness in Docket No. R87-1, and presented direct testimony concerning volume forecasts for Priority Mail and Express Mail in Docket Nos. R90-1, R94-1 and R97-1.

PURPOSE AND SCOPE OF TESTIMONY

One purpose of this testimony is to present forecasts of volumes for Express Mail service at the current and the new rates proposed by the United States Postal Service. In addition, my testimony includes similar volume forecasts for Priority Mail. For both Priority Mail and Express Mail two sets of forecasts are presented:

a) mail volumes that will occur in the Test Year if the current Postal Service rate and classification schedules remain in effect, referred to as the "before-rates" forecast;

and

b) mail volumes that will occur in the Test Year if the rates and classifications proposed by the Postal Service in this proceeding are adopted, referred to as the "after-rates" forecast.

The method used in forecasting mail volumes is to project changes in mail volumes between a Base Year and the Test Year. The Base Year used in the forecasts began on September 12, 1998 and the Test Year begins on October 1, 2000.

In the testimony, recent volume experience is reviewed. Factors determining Express Mail and Priority Mail volumes, which are taken into account in making the forecasts, are discussed. Detailed explanations of the econometric analyses and related studies used in making the volume forecasts are provided in the Technical Appendices accompanying this testimony. A guide to the testimony and documentation is provided following the summary.

SUMMARY

The first part of my testimony presents the Test Year volume forecasts for Priority Mail. The second part of the testimony presents the Test Year volume forecasts for Express Mail. In the before-rates forecast the existing postal rate schedules for Express Mail and Priority Mail are projected to continue to prevail during the Test Year, whereas, in the after-rates forecast the new rates and classifications proposed by the Postal Service in this proceeding are projected to prevail during the Test Year.

The Base Year for these forecasts consists of four postal quarters starting at the beginning of the first postal quarter of the 1999 Postal Year (September 12, 1998). The Test Year coincides with Government Fiscal Year 2001 which begins on October 1, 2000 and ends on September 30, 2001. Thus, the Test Year begins approximately twenty-four months after the beginning of the Base Year. After-rates Test-Year volumes are projected assuming that proposed rates and classifications become effective October 1, 2000, the same time as the beginning of the Test Year. Table 1 summarizes the projections of mail volumes for 1999 through quarter one of 2002, assuming first, that Priority Mail and Express Mail nominal rates remain unchanged (before-rates), and second, that Priority Mail rates increase by 15.06 percent. The proposed Express Mail rates increase by approximately 3.82 percent in the after-rates forecast. The Base-Year Period volume for Priority Mail was 1,188 (1,187.813) million pieces and the Base-Year Period volume for Express Mail was 68 (68.366) million pieces.

TABLE 1
VOLUME PROJECTIONS
(MILLION PIECES)

BASE YEAR: Postal Quarter 99:1 - 99:4

Priority Mail	1187.813
Express Mail	68.366

Before-Rates

Postal Qtr	Priority	Express	Postal Year	Priority	Express
2000:1	271.724	15.028	2000	1205.872	69.477
2000:2	286.588	16.609	2001	1324.229	71.491
2000:3	287.397	16.584			
2000:4	360.163	21.256			
2001:1	293.441	15.250			
2001:2	319.182	17.173			
2001:3	316.372	17.073	GFY	Priority	Express
2001:4	395.234	21.995	2000	1217.641	69.876
2002:1	320.137	15.832	2001	1331.105	71.641

After-Rates

Postal Qtr	Priority	Express	Postal Year	Priority	Express
2000:1	271.724	15.028	2000	1205.872	69.477
2000:2	286.588	16.609	2001	1228.038	72.079
2000:3	287.397	16.584			
2000:4	360.163	21.256			
2001:1	287.509	15.274			
2001:2	300.721	17.222			
2001:3	286.297	17.233	GFY	Priority	Express
2001:4	353.511	22.350	2000	1217.641	69.876
2002:1	286.153	16.110	2001	1226.160	72.301

The forecasts are based on projections of changes in factors affecting mail volumes between the Base Year and the Test Year. The first factor considered in projecting mail volumes is the price paid by the mailer. The effect of price on volume is estimated as a response to price in real terms, i.e., nominal postal price deflated by an index of the general level of prices. Rather than occurring immediately, response to price occurs over a period of time. A change in deflated price is estimated to lead to a volume response in the quarter in which the price change occurs and the three following quarters. The volume responses to price are expressed as price elasticities (the price elasticity can be interpreted as the percent change in volume that would result from a one percent change in real price). Effects of real price changes on the Test-Year volume forecast are obtained by applying estimated price elasticities to percentage changes in real prices between the Base Year and the Test Year.

The Postal Service proposes changes in prices of Priority Mail and Express Mail. The proposals for Priority Mail are explained in detail by Postal Service witness Robinson (USPS-T-34). The proposals for Express Mail are explained in detail by Postal Service witness Plunkett (USPS-T-36). The net impact of the proposals is to increase rates from what they would otherwise be in the Test Year.

A second factor considered is the growth in real income per adult. The effect of real income growth on Priority Mail volumes is projected by combining the long-run income elasticity (the percentage increase in volume that would result from a one percent increase in real long-run income per adult) for Priority Mail with the projected percentage increase in real income. Both long-run and short-run income measures were used. In the case of

Express Mail, the real (per adult) nondurables personal consumption component of Gross Domestic Product was used as our measure of long-run macro economic activity.

Adult population is the third factor considered. The projected percentage increase in adult population is estimated to increase Express Mail and Priority Mail volumes by approximately two percent (0.0182), between the Base Year and Test Year.

Additional specific factors, such as the prices of substitute services, also affect demand for Express Mail, as well as Priority Mail. For those factors that are quantifiable, and for which predicted values are available, an elasticity is estimated and used in connection with the projected percentage change for that factor. All of the variables, except those noted in the testimony, are in natural logarithms.

The text of this testimony presents a discussion of factors that affect the demand for Express Mail, and Priority Mail. It also presents the resulting volume projections. Technical Appendices are provided giving a detailed description of the methods used and the Choice Trail.

In the case of Priority Mail, Table 1 shows that volume is projected to increase from 1,188 million (1,187.813) pieces in the Base-Year period to 1,331 million (1,331.105) pieces in the before-rates environment in the Test Year. The increase is approximately twelve percent (0.1206) for Priority Mail in the 24 month period, corresponding to an average annual compound growth rate of 5.9 percent (0.0586). The projection for Priority Mail volume in the after-rates environment is 1,226.160 million pieces, which totals a 7.9 percent (-0.0788) decrease or a reduction of 105 million (-104.945) pieces from what it otherwise would have been.

Table 1 shows that Express Mail volume is projected to increase from 68 million (68.366) pieces in the Base Year period to 72 million (71.641) pieces in the before-rates environment in the Test Year. The increase is approximately 4.8 percent (0.0479) for Express Mail over the 24 month period, corresponding to an average annual growth rate of 2.4 percent (0.0237). Because the proposed increase in Express Mail price is small (3.82 percent) compared to the proposed increase in Priority Mail price (15.06 percent), the own-price effect reducing volume is off-set by the larger cross-price effect increasing volume. The details are explained in section II.E.2. The projection for Express Mail volume in the after-rates environment is 72 million (72.301) pieces, which totals a 0.9 percent (0.0092) increase. Express Mail volume would be increased from 71.641 million pieces in the before-rates environment to 72.301 million pieces in the after-rates Test Year environment, an increase of approximately 0.7 million pieces (0.66), or a slightly less than one percent change.

GUIDE TO THE TESTIMONY AND DOCUMENTATION

Testimony:

The testimony presents forecasts of the volume for both Priority Mail and Express Mail. For each class of mail, two forecasts are presented. The first forecast is under the conditions that the current rates remain in effect and the second one is under the conditions that the new rates proposed by the Postal Service are adopted. Five technical appendices are included with the testimony. Technical Appendix A contains the explanation of how the UPS person days lost to strikes elasticity is calculated. Technical Appendix B explains how the seasonal variables are computed. Technical Appendix C explains how the logistic growth variable is computed. Technical Appendix D contains the choice trail explaining the development of the current model from the R97-1 version. Technical Appendix E contains forecast error analyses and net trends.

Fixed-Weight Price Indices:

As in the other classes of mail, fixed-weight price indices (FWPIs) are used to measure the aggregate level and changes in rates. Library Reference I-111 Section A contains the derivation of these indices in the before-rates environment for Express Mail, Priority Mail and UPS Ground Service. Library Reference I-111 Section B contains the derivation of these indices in the after-rates environment for Express Mail and Priority Mail. The FWPIs are based on the 1998 billing determinants. Library Reference I-111 Sections A and B contain both printed values and spreadsheets developing the indices.

Regression Materials:

Multiple regression analysis is used to estimate the elasticities. We use a well-known econometrics statistical program called Regression Analysis of Time Series (RATS). As in the other classes of mail, the elasticities are combined with explanatory variables to form multipliers. These multipliers are used to compute the volume forecasts. The methodology for computing multipliers is contained in witness Tolley's (USPS-T-6) Technical Appendix.

The details of the multiple regression results for Priority Mail, in printed form, are presented in Library Reference I-112, Section A . For Express Mail, the details of the multiple regression results, in printed form, are presented in Library Reference I-112, Section B. The data are presented in Section C.

Computer instructions for econometrics software:

Library Reference I-112, Section D contains the computer files with the data and input files, for both Priority and Express Mail. The files in this section can be use as direct input to the econometrics software to produce the estimates in the testimony. The files contain the instructions, in text file form, that are directly useable by the econometrics software. In addition, there are files containing the output directly from the econometrics software, for both Priority Mail and Express Mail.

Multipliers and Forecasts:

The details of the multipliers for Priority Mail, in printed form, are presented in

Library Reference I-113, Section A. The details of the multipliers for Express Mail, in printed form, are presented in Library Reference I-113, Section B. The volume forecasts for Priority Mail are calculated, using the multipliers, in the spreadsheets in Library Reference I-113, Section C. The volume forecasts for Express Mail are calculated, using the multipliers, in the spreadsheets in Library Reference I-113, Section D.

Priority Mail volume transfer:

In R97-1 the minimum weight for Priority Mail was changed from 11 to 13 ounces. Library Reference I-114 contains the forecasts of Priority Mail volume that are projected to transfer to First-Class Mail in the before-rates and the after-rates case based on our model.

Supplemental Technical Appendix:

In reviewing my testimony, I discovered a minor error in constructing the after-rates fixed-weight price index for Priority Mail. It would have very small impacts on the forecasts. Pages SA-1 through SA-3 of my Supplemental Appendix contain a summary of the volume impacts the changes would make. Details of the changes are in Library Reference I-129, Sections A through D.

PRIORITY MAIL

A. Characteristics

Priority Mail is an expedited service for mail weighing 70 pounds or less. Under current regulations, all First-Class Mail over 13 ounces must travel as Priority Mail. At the option of the mailer, First-Class matter weighing less than 13 ounces may travel as Priority Mail as well. The structure of the rates for Priority Mail is a combination of unzoned and zoned rates. Pieces weighing between 13 ounces and two pounds have a single unzoned rate, as does the flat-rate envelope. A flat-rate envelope was approved in the R90-1 general rate case. It is priced at the two-pound rate and comprises approximately 10.3 (0.1032) percent of Priority Mail total volume. Under the current rate structure, rates for pieces in excess of two pounds increase for each additional pound up to five pounds and are unzoned. Pieces exceeding five pounds are zoned, with the rates for zones 1, 2 and 3 combined, and rates increase for each additional pound up to the maximum of 70 pounds. Witness Robinson (USPS-T-34) presents the Postal Service's proposed changes to the rates.

B. Volume Since 1970

The Base Year Period, is 1999:1 to 1999:4, the postal fiscal year, called PFY1999. Table 2 displays Priority Mail volumes for Base Year periods from PFY1970 to PFY1999 in five year increments, and annually. Volume increased by about eleven percent (0.111) from PFY1970 to PFY1975. From PFY1975 to PFY1980 it increased by about twenty-one

TABLE 2

PRIORITY MAIL
Volume*

Postal Qtrs	Volume (Millions)	Pieces per Adult
70:1 - 70:4	183.347	1.523
75:1 - 75:4	203.755	1.547
80:1 - 80:4	245.981	1.685
85:1 - 85:4	306.496	1.924
90:1 - 90:4	485.747	2.859
91:1 - 91:4	497.255	2.892
92:1 - 92:4	550.394	3.161
93:1 - 93:4	674.084	3.824
94:1 - 94:4	779.475	4.375
95:1 - 95:4	852.036	4.734
96:1 - 96:4	936.211	5.149
97:1 - 97:4	1065.555	5.807
98:1 - 98:4	1167.999	6.313
99:1 - 99:4	1187.813	6.368

Growth Rates

BY Period	Volume	Pieces per Adult
1970 - 1975	11.1%	1.6%
1975 - 1980	20.7%	8.9%
1980 - 1985	24.6%	14.2%
1985 - 1990	58.5%	48.5%
1990 - 1995	75.4%	65.6%
1995 - 1999	39.4%	34.5%
1970 - 1999	547.8%	318.0%
1980 - 1999	382.9%	278.0%
1990 - 1999	144.5%	122.8%
1991 - 1994	56.8%	51.3%
1994 - 1999	52.4%	45.6%
1996 - 1999	26.9%	23.7%

* Agency and Franked Mail Distributed from 1993:1 onwards.

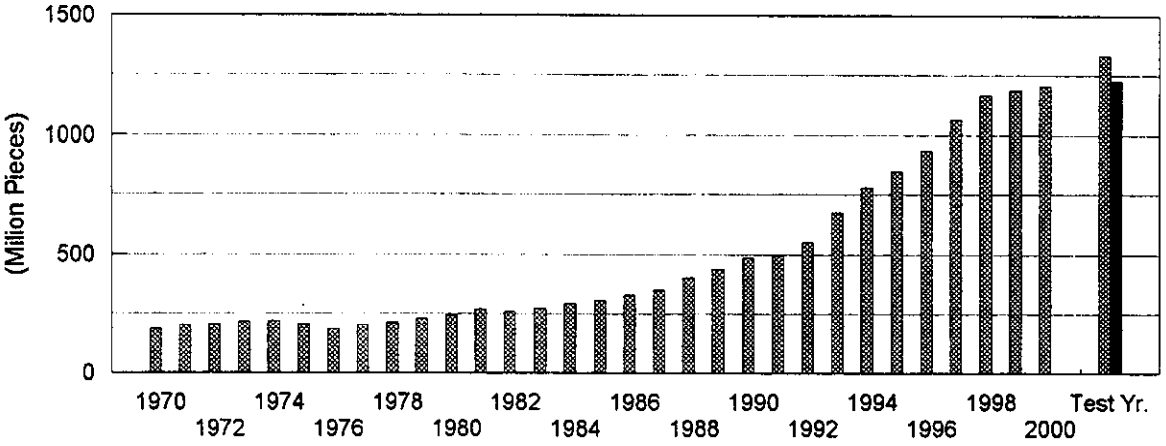
percent (0.207), and it increased almost twenty-five percent (0.246) over the following five years. From PFY1985 to PFY1990 volume increased by fifty-nine percent (0.585) and from PFY1990 to PFY1995 it increased by seventy-five percent (0.754). Over the period from PFY1970 to PFY1999 the total volume of Priority Mail increased by about 548 percent (547.8%). On a pieces-per-adult basis, the percent increase over the PFY1970-PFY1999 period was 318 percent (318.0%).

Over the last five years, from PFY1994 to PFY1999, volume increased by fifty-two percent (0.524), and over the last three years, PFY1996 to PFY1999, it increased by twenty-seven percent (0.269). Figure 1 illustrates these and other historical volume changes. The figure also displays the before and after rates test year volumes.

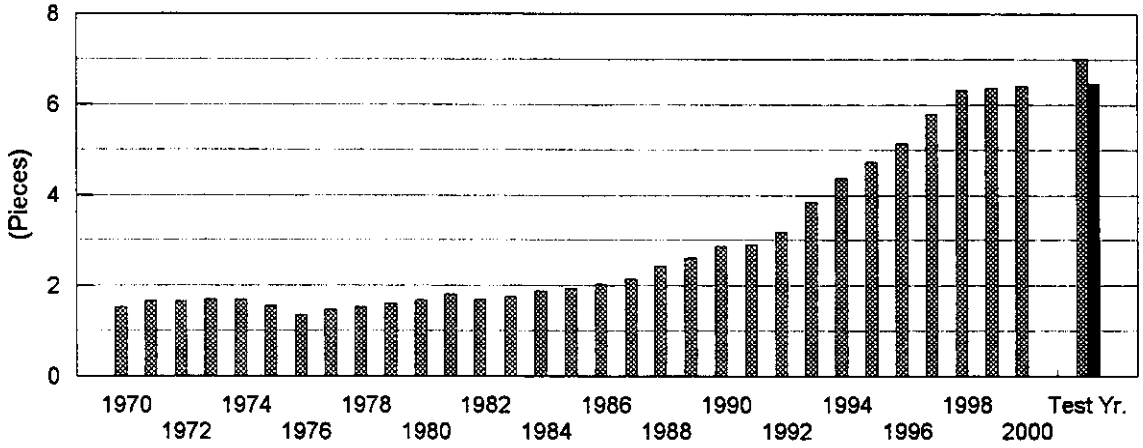
An econometrics model to determine factors affecting Priority Mail volume was estimated using quarterly data for volume, on a pieces-per-adult, per postal accounting period basis. Unless noted in the testimony, all variables are measured in natural logarithms. The econometrics results are presented in Table 3, and the complete data set is presented in Library Reference I-112, Section C. Regression results are contained in Library Reference I-112, Sections A and B. Volume forecast multipliers are contained in I-113, Sections A and B, with the forecasts in Section C. (For a general discussion of volume multipliers see witness Tolley, USPS-T-6, Technical Appendix.)

FIGURE 1. HISTORICAL AND FORECAST PRIORITY MAIL VOLUME

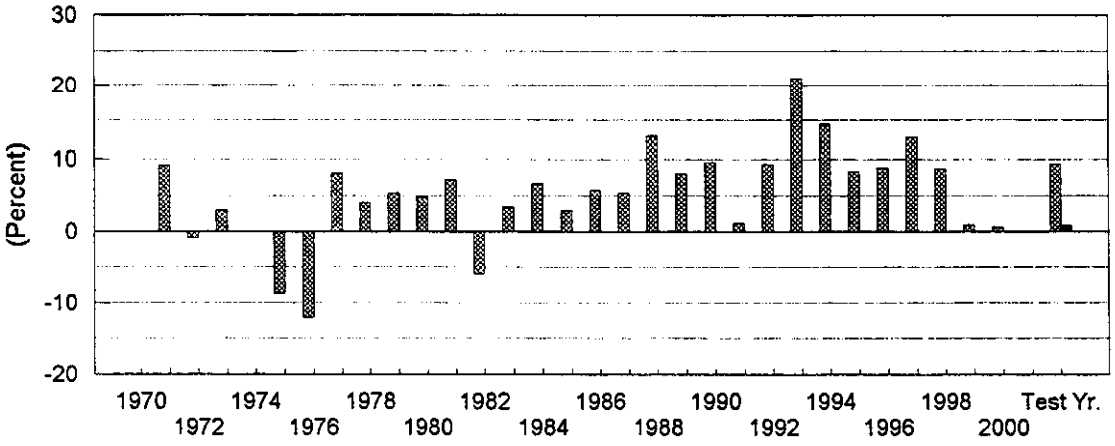
A. Total Volume



B. Volume Per Adult



C. Percent Change in Volume Per Adult



Before Rates After Rates

Test Year: GFY 2001

TABLE 3
PRIORITY MAIL
Econometric Results

Dependent Variable VOL8PA - Estimation by Restricted Regression
Quarterly Data From 1970:03 To 1999:04

Usable Observations	118	Degrees of Freedom	85
Centered R**2	0.993446	R Bar **2	0.990978
Uncentered R**2	0.999505	T x R**2	117.942
Mean of Dependent Variable			-1.68861706
Std Error of Dependent Variable			0.484712867
Standard Error of Estimate			0.046039726
Sum of Squared Residuals			0.180170794
Durbin-Watson Statistic			2.085691
Q(29-0)			28.495808
Significance Level of Q			0.49153762

Variable	Coeff	Std Error	T-Stat	Signif
Constant	-4.675	0.768	-6.08674	3.0000E-08
PX8	-0.205	0.149	-1.37991	0.17123201
PX8{1}	-0.313	0.157	-1.98771	0.05006324
PX8{2}	-0.282	0.145	-1.94043	0.05564209
PX8{3}	-1.922e-002	0.13	-0.14792	0.88275259
PX8{4}	-2.776e-017	1.625e-009	-1.70755e-008	1
YPERM92	0.95	0.206	4.61607	0.00001374
VOLWT	-0.664	0.178	-3.72632	0.00034904
UPSMDLS	2.320e-002	7.171e-003	3.2348	0.00173473
UPSPOTM	-0.294	3.689e-002	-7.96213	0
JS_PNS	0.113	3.434e-002	3.28157	0.00149861
PX25FWI98	3.538e-002	4.212e-002	0.83994	0.40329576
PX25FWI98{1}	1.640e-002	2.587e-002	0.63374	0.52795469
PX25FWI98{2}	3.686e-003	2.361e-002	0.15615	0.8762856
PX25FWI98{3}	1.378e-006	1.908e-002	7.22313e-005	0.99994254
PX25FWI98{4}	3.469e-018	1.270e-009	2.73136e-009	1
UPSCP	0.199	0.142	1.40258	0.16438531
UPSCP{1}	4.182e-002	8.596e-002	0.48645	0.62789963
UPSCP{2}	7.050e-003	9.060e-002	0.07781	0.93816164
UPSCP{3}	5.728e-003	9.059e-002	0.06323	0.94973409
UPSCP{4}	-2.776e-017	1.512e-009	-1.83565e-008	1
DUPS	-1.218	0.25	-4.88312	4.8500E-06
D_UPSL0	0.313	0.231	1.35395	0.17934099
D_UPSL1	0.37	0.112	3.30287	0.00140137
D_UPSL2	0.41	0.123	3.34106	0.00124167
D_UPSL3	0.292	0.119	2.45611	0.01608063
D_UPSL4	0	0	0	0
DNOGOV	-4.038e-002	4.265e-002	-0.94661	0.3465195
DUPSSTK	8.014e-002	4.747e-002	1.68834	0.09501191
DUPSSTK{1}	6.692e-002	4.564e-002	1.46617	0.14629312
DUPSSTK{2}	5.695e-002	4.565e-002	1.24755	0.21562052
DUPSSTK{3}	1.683e-005	4.566e-002	3.68646e-004	0.99970673
DUPSSTK{4}	3.469e-018	0	0	0
FL	5.306e-002	2.451e-002	2.16425	0.03324995
WT	8.051e-002	1.596e-002	5.04611	2.5300E-06
SP	8.703e-002	1.260e-002	6.90853	0
DEC1_23	0.345	0.108	3.20882	0.00188054
DEC24_JAN1	-0.723	0.224	-3.22543	0.00178608

TABLE 3 (Continued)
PRIORITY MAIL
Econometric Results

SHILLER SMOOTHNESS PRIORS	
Own Price	K = 0.004
Parcel Post cross price	K = 3.150
UPS Ground Service cross price lags 0 through 4	K = 0.042
UPS cross price lags 0 through 4 interacted with DU	K = 0.052
UPS strike of 1997:4	K = 0.045

Data Legend

VOL8PA	Priority Mail quarterly volume per accounting period per adult.
Constant	Constant term.
PX8	Priority Mail price index deflated by personal consumption expenditures price deflator (chained).
YPERM92	Real permanent disposable income per adult.
VOLWT	Minimum weight requirement to classify a piece of mail as Priority Mail.
UPSMDLS	United Parcel Service's mandays lost due to strike.
UPSPOTM	United Parcel Service's potential market.
JS_PNS	Standard and Poor's Index of 500 common stock prices.
PX25FWI98	Parcel Post price index deflated by personal consumption expenditures price deflator (chained).
UPSCP	United Parcel Service's Ground price index deflated by personal consumption expenditures price deflator (chained).
DUPS	Binary shift variable 0 up to and including 91:2 when R90-1 rate rate increase took effect, 1 thereafter.
D_UPSLx	Interaction-slope varaible, where UPS price is multiplied by DUPS, where x represents the lag.
DNOGOV	Binary variable for PM volume excluding Agency and Franked Mail equals 1 up to 1993:4 and 0 from 1994:1 onwards.
DUPSSTK	Binary variable for UPS strike in 1997:4.
FL	Binary variable for Fall.
WT	Binary variable for Winter.
SP	Binary variable for Spring.
DEC1_23	Proportion of business days in a quarter between December 1, and December23 inclusive.
DEC24_JAN1	Proportion of business days in a quarter between December 24, and January 1 inclusive.

C. Changes to the Model

1. No Fundamental Changes

There were no fundamental changes to the Priority Mail model as presented in the R97-1 general rate case. The changes which were made were generally in the areas of improving the measurement of the influence of seasons and changes to better measure the lag structure impact of the UPS prices. In addition, we added a measure of the impact of the 1997 UPS strike.

a. Seasonal Patterns

A pattern of moving seasonal fluctuations in Priority Mail volumes was found to exist in the previous general rate case, R97-1. To account for this pattern of seasonal influences we used a statistical technique called X-11. The computer program we used was from the national statistics office of Canada called Statistics Canada but was not Y2K compliant. While they promised to have a revised version of their program, we decided to account for the moving seasons with binary variables in the econometrics software we use to estimate the model itself.

Christmas is an important season for Priority Mail. In 1981 and earlier calendar years, Christmas Day fell in the first postal quarter. In calendar 1982, Christmas Day became the first day of postal quarter two of postal fiscal 1983. Since then, the number of days prior to Christmas, in postal quarter two, has increased. The second quarter of postal fiscal year 1999 began on December 5, 1998 and thus included 15.5 pre-Christmas days (Sundays are not counted and Saturdays are counted as half days). Due to the migration of Christmas Day from postal quarter one to quarter two, the amount of

Christmas Priority Mail has moved from postal quarter one to quarter two. As explained in Technical Appendix B, we defined the pre-Christmas period to be December 1 through December 23 and the post-Christmas period to be December 24 through January first. Both variables had the expected signs indicating more mail in the pre and less mail in the post-Christmas season. These variables are combined with the postal quarter variables to obtain the moving season impact index (see Technical Appendix B). The index is used to account for the effect of the moving seasonal pattern (see section D.4.d below).

b. Competitive Conditions

Recently, UPS has been moderating their price increases. In the new model, the UPS lag price structure was modified to measure the influence of the increasingly competitive services in the model. Earlier we used United Parcel Service Ground Service prices with both a current year and a lagged year impact. Now, the current period and the four lagged quarters are used. Both the current period and lagged values are now incorporated into the model and the same binary variable formulation, as in R97-1, continues to be used to measure the continued competitive nature of the industry. These variables are discussed in Section D.3.b.

c. UPS Strike

From August 4,1997 to August 19,1997, United Parcel Service Teamsters employees were on strike. According to the Department of Labor, 185,000 UPS employees were on strike. It was a major strike influencing all of the U.S. package shipping industry. Because the strike was considerably larger than other UPS strikes we decided to model it as a separate economic event. The influence of added volume due to

this strike was captured in the Priority Mail model by using a binary variable with a value of unity for 1997.4, instead of the person-days lost due to strikes variable. In addition, it was assumed that there could be increases in volume for the three subsequent quarters generally decreasing over the four quarters following the strike. The results indicate that the strike impact followed this pattern with only small additional volume in the third quarter following the strike (see Section D.4.b below).

D. Factors Affecting Volume

1. Own Price

Priority Mail's own price is an important influence on volume. The own-price elasticity can be interpreted as the percentage change in volume that would result from a one percent change in price. Own-price elasticity is estimated to be equal to -0.82 (-0.819), and is statistically significant with an estimated t = -5.47. From PFY1994 to PFY1999 the real price of Priority Mail decreased (on a weighted average basis) by 2.2 percent (0.0224) and is estimated to have increased per adult annual volume by approximately 1.8 percent (0.0184). The 1.8 percent (-0.0178) decrease in real price over the last three years, from PFY1996 to PFY1999 resulted in a 1.5 percent (0.01456) increase in volume, holding all of the other factors constant. The change in real (or inflation adjusted) price is not the only factor affecting volume.

2. Income

As in R97-1, the long-run income elasticity is estimated using "Mixed Estimation", a

well-known econometrics technique.[1] Long-run income measured by our permanent income variable, has an estimated elasticity equal to 0.95. It is statistically significant with a t-value of 4.62. For every one percent increase in (inflation adjusted) permanent income, Priority Mail volume is estimated to increase by 0.950 percent. From PFY1994 to PFY1999 per adult permanent income increased by about 7.1 percent (0.0708), and we estimate that per adult Priority Mail increased by 6.7 percent (0.0672) due to this factor alone. Over the most recent three years, the PFY1996 to PFY1999 period, real long-run income increased by 4.9 (0.0488) percent and resulted in, an increase of approximately 4.6 percent (0.950 x 0.0488=0.0464) in Priority Mail volume.

As in R94-1 and R97-1, expected short-run or transitory income is measured by the Standard and Poor's Index of stock prices, and is an independent factor influencing Priority Mail. It has an estimated elasticity of 0.11 (0.1127). From PFY1994 to PFY1999 this index increased by 171 percent (1.7060), and the resulting increase in per adult volume is estimated to be approximately 19 (0.1922) percent. For PFY1996 to PFY1999, the increase was 97 percent (0.9671) resulting in an 11 percent (0.1090) volume increase. These three factors, price plus long and short-run income changes amount to about a thirty (0.2958) percent increase and a eighteen (0.1773) percent increase in volume over the last five and three years, respectively.

3. Prices of Alternative Services

a. Parcel Post

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[1] See Jan Kmenta, Elements of Econometrics, Second Edition, University of Michigan Press 1997, Pp.497-500.

Mailers may choose to send some items via Parcel Post. The cross-price elasticity is estimated to be 0.055. A one percent increase in Parcel Post rates would lead to a 0.06 percent increase in Priority Mail volume. From PFY1994 to PFY1999 the weighted average Parcel Post rates increase in real terms was 13.2 percent (0.1323), and we estimate that Priority Mail increased about one percent (0.0073) due to this cross-price effect, holding all other factors constant. Over the most recent three years, from PFY1996 to PFY1999, the real rate decrease was 0.5 percent (-0.0051) resulting in a 0.03 (-0.0003) percent decrease in volume.

b. United Parcel Service

Shippers may choose to send some items via UPS ground service. The cross-price elasticity is estimated to be 0.254. A one percent increase in UPS ground prices is estimated to increase Priority Mail volume by 0.25 percent. From PFY1994 to PFY1999 the weighted average, inflation adjusted, price of UPS ground service increased by 16.3 percent (0.1627) resulting in an estimated volume increase of 4.1 percent (0.0413) in Priority Mail. In the last three years the price increase was 9.5 percent (0.0952), resulting in a 2.4 percent (0.0242) volume increase.

In addition, the expedited delivery market continues to be highly competitive. One can expect shippers to continue to be sensitive to the price of competing services. As in the R94-1 and R97-1 cases, we measure the impact of that highly competitive environment by constructing a binary shift variable having the value zero up to and including the quarter when the R90-1 Priority Mail rate increase took effect (1991:2). In the subsequent quarters (1991:3+) the value is one. At the same time, we also

constructed an interaction-slope variable where UPS prices current and lagged one through four quarters are multiplied by the binary variable.[2] The estimated coefficient of the shift variable is -1.218, and the sum of the four slope coefficients is 1.38 (1.3848). Both the shift and slope variables are statistically significant. These two variables combined are estimated to have resulted in an increase in Priority Mail volume of twenty-three percent (0.2253) over the last five years (PFY1994 to PFY1999) and thirteen (0.1319) percent over the last three years (PFY1996 to PFY1999).

4. Additional Factors

a. Minimum Weight

As discussed in the Characteristics Section, the classification separation between First-Class and Priority Mail occurs at the minimum weight point. The weight minimum has varied over time, and is currently thirteen ounces. A weight variable was used in the econometrics analysis to account for these changes in minimum weight. As in R94-1 and in R97-1, the variable was constructed by dividing the minimum weight by twelve. Thus, in 1997 when the minimum weight of a piece of mail required to be classified as Priority Mail was eleven ounces, our variable was equal to 0.917 (11/12). The current minimum weight is thirteen ounces, and our variable VOLWT is 1.08 (13/12). Its estimated elasticity is -0.664. One would expect this inverse result. That is, an increase in the minimum weight would cause a reclassification of what would otherwise be Priority Mail into First-Class Mail. Thus, we would have less mail classified as Priority Mail. From a

[2] This is a standard econometrics technique. See Jan Kmenta, Elements of Econometrics, Second Edition, University of Michigan Press 1997, Pp. 461-73.

value of 0.917 in PFY1996 to a weighted average value of 1.0286 in PFY1999, the variable increased approximately 12 percent (0.1221), and based on the -0.664 elasticity, it is estimated to have resulted in a decrease in Priority Mail of approximately eight percent (-0.0801). No change in the current volume-weight variable is proposed.

b. UPS Strikes

In addition to the traditional demand variables of price and income, there are additional variables associated with competition that are related to Priority Mail volume. The first variable is person days lost due to strikes at United Parcel Service. This firm provides services which compete with those provided by the Postal Service. When strikes occur, it is plausible that the volume in Priority Mail would increase. That is, if UPS service were not available or if strike activity increased the risk of delay in a UPS shipment, some customers would shift to Priority Mail.

Our results are consistent with this hypothesis, and the estimated parameter is statistically significant and positive. Since there are quarters in the sample with zero days lost due to strikes, and the logarithm of zero is undefined in those cases, we used the level of the variable rather than its logarithm. One implication of our formulation is that the coefficient is not the elasticity. The elasticity can be computed in a straightforward manner. The method to perform these calculations and the results are presented in Technical Appendix A. One result is that the elasticity is not a constant. This result is similar to the linear demand case where the slope or price coefficient is constant, but the elasticity varies along the demand curve.

Our model estimates that the almost 57.8 thousand person days lost in quarter

four of 1970 resulted in an increase in Priority Mail volume of approximately 0.694 million pieces. Until 1997, the largest strike quarter was quarter one of 1977 where approximately 630 thousand person days were lost. In this quarter Priority Mail volume is estimated to have increased by 6.892 million pieces, holding all other factors constant. Other than the 1997 strike, there had been only one work stoppage since 1983. It occurred on February 7, 1994, and was a partial one-day labor dispute concerning the increase in the UPS maximum weight limit from 70 to 150 pounds. It amounted to 40 thousand person days lost and resulted in an increased volume of 1.699 million pieces of Priority Mail, or one percent (0.0100) of that quarter' s volume.

However, the 1997 according to the Department of Labor approximately 185,000 UPS workers were on strike from August 4 to August 19,1997. Our model indicates that the added volume due to the 1997 strike was approximately 59.6 (59.582) million pieces. Our forecasts assume that no strikes will take place in the Test Year. Therefore, Priority Mail volume would not be increased by UPS strikes in the Test Year.

c. UPS Market Potential

This variable measures the market penetration of United Parcel Service. Our sample period began in 1970, and at that time it was estimated that UPS had penetrated, or had a potential to serve, about 50 percent (0.5) of the national market. That is, its services were available to about half of the U.S. households. That potential grew to 100 percent in 1981.

One would expect the sign of this variable to be negative in our model. That is, as

UPS was able to serve a larger proportion of the national market they became a more effective competitor. The estimated elasticity is statistically significant, and equal to -0.294.

Over the sample period the measure of market penetration, or national market potential increased by 97.6 percent. The net result is that Priority Mail decreased by approximately 29 percent (-0.2931) due to the increased competition from United Parcel Service. Since the potential grew to 100 percent in 1981, it had no additional impact thereafter. In our forecast we assume that UPS will continue to have a 100 percent market service potential.

d. Seasonal Patterns

As explained above, the Pre and Post-Christmas variables are combined with the postal quarter variables to obtain the moving season impact index (see Technical Appendix B). Table 4 of partial autocorrelations shows the residual pattern after the moving season process is completed. Based on that table, the Durbin-Watson statistic, and the autoregression diagnostic regressions in Library Reference I-112, Section A. pages 47-49, indicate that no adjustments at this stage such as those for autocorrelation were necessary. Table 5 and the Durbin-Watson statistic in Table 3 confirm that no further autocorrelation adjustments were necessary. The impacts of the moving seasons adjustments are converted to seasonal factors in the forecasts. The method of computing these factors is shown in Technical Appendix B and is the same as that used in Express Mail. While the index values are much the same from year to year, over a longer period the changes are larger. For example in PFY1994 the seasonal values were

Fall = 1.0379, Winter = 1.0163, Spring = 1.0256, and Summer = 0.9401 and by PFY2000 the values are Fall = 1.0075, Winter = 1.0469, Spring = 1.0256, and Summer = 0.9401. When the quarterly values are weighted by the number of accounting periods in the quarter (3/13, 3/13, 3/13 and 4/13), the values sum to one indicating that the index allocates the moving season impact within the postal fiscal year. See Technical Appendix B.

TABLE 4

Priority Mail

Prior to estimation subject to lag structure restrictions

PARTIAL AUTOCORRELATIONS AND 95 % CI AROUND ZERO

LAG	LOWER BOUND	PAC*	UPPER BOUND	SIGNIFICANT
0	0.0000	1.0000	0.0000	0
1	-0.1849	-0.0883	0.1849	0
2	-0.1857	0.0229	0.1857	0
3	-0.1865	-0.0797	0.1865	0
4	-0.1873	0.0792	0.1873	0
5	-0.1881	-0.1141	0.1881	0
6	-0.1890	-0.1025	0.1890	0
7	-0.1898	-0.0313	0.1898	0
8	-0.1907	-0.1792	0.1907	0
9	-0.1916	0.0631	0.1916	0
10	-0.1925	0.1129	0.1925	0
11	-0.1933	-0.0285	0.1933	0
12	-0.1943	-0.1969	0.1943	1
13	-0.1952	0.1061	0.1952	0
14	-0.1961	-0.0987	0.1961	0
15	-0.1971	-0.1176	0.1971	0
16	-0.1980	-0.0610	0.1980	0
17	-0.1990	-0.0896	0.1990	0
18	-0.2000	-0.0805	0.2000	0
19	-0.2010	-0.0784	0.2010	0

*Partial Autocorrelation Coefficient

TABLE 5

Priority Mail

Final Estimates

PARTIAL AUTOCORRELATIONS AND 95 % CI AROUND ZERO

LAG	LOWER BOUND	PAC*	UPPER BOUND	SIGNIFICANT
0	0.0000	1.0000	0.0000	0
1	-0.1849	-0.0461	0.1849	0
2	-0.1857	-0.0200	0.1857	0
3	-0.1865	-0.0927	0.1865	0
4	-0.1873	0.1512	0.1873	0
5	-0.1881	-0.1869	0.1881	0
6	-0.1890	-0.0310	0.1890	0
7	-0.1898	-0.0551	0.1898	0
8	-0.1907	-0.1661	0.1907	0
9	-0.1916	0.0324	0.1916	0
10	-0.1925	0.1061	0.1925	0
11	-0.1933	-0.0225	0.1933	0
12	-0.1943	-0.1111	0.1943	0
13	-0.1952	-0.0697	0.1952	0
14	-0.1961	-0.1694	0.1961	0
15	-0.1971	-0.0286	0.1971	0
16	-0.1980	-0.0320	0.1980	0
17	-0.1990	-0.0586	0.1990	0
18	-0.2000	-0.0521	0.2000	0
19	-0.2010	-0.1161	0.2010	0

*Partial Autocorrelation Coefficient

e. Population

The dependent variable is quarterly Priority Mail per postal accounting period divided by the adult population 22 years of age and older. From PFY1994 to PFY1999 the increase in Priority Mail due to population growth was approximately 4.7 percent (0.0468), and from PFY1996 to PFY1999 it was about 2.6 percent (0.0259).

f. Government Volume

Prior to the R97-1 rate case, the models were based on volume data that did not include government volume. Beginning with the R97-1 case, only "with government" volume data would be available. So that future projections would include forecasts of the "with government" volume data, the two data sets were combined. Data including government volume begins in postal quarter one 1993. To account for the fact that the early data did not include government volumes, a binary variable was added with its value set equal to one from the beginning of the sample up to and including postal quarter four 1992. Beginning in quarter one of fiscal 1993, the value is set to zero, to the end of the estimation period. The coefficient's estimated value is -0.040 indicating that the previous data "without government" volume was lower. The variable continues to remain at zero through the Test Year and does not alter the forecast.

E. Volume Forecasts

1. R97-1 Forecast Accuracy

In the response to an interrogatory (UPS/USPS-T8-2) in R97-1, we replied that the forecasts of Priority Mail volume were expected be in the range of plus or minus 11 percent of the actual value. The forecast for PFY1998 was 1,123.852 million pieces and

the actual volume was 1,167.999 million pieces, an error of 3.8 (0.0378) percent. When the actual values for the right-hand side variables are used, the forecast would be 1,168.078, an error of 0.007 (0.00007) percent. This extraordinarily close forecast does not alter our view that future forecasts generally should be in the plus or minus 11 percent range.

2. Test Year Forecasts

Projecting the combined influences of prices, incomes, and population gives a projection of 1,331 million (1,331.105) pieces of Priority Mail for the Test Year beginning October 1, 2000, if present postal rates are continued (before-rates forecast). If the rates proposed by the Postal Service are recommended, the forecast is 1,226 million (1,226.160) pieces (after-rates forecast).

A. Characteristics

1. Introduction

Express Mail is an unzoned service offered for shipment of all mailable matter of 70 pounds or less. It is an expedited service guaranteeing same day, next day or second day delivery, depending on the service purchased and the location of the addressee. Beginning in 1970, as a pilot program with the Federal National Mortgage Association and six of its regional offices, it gradually grew through phases of test marketing in the early and mid 1970's, to an official class of mail in late 1977. In February of 1978 it served 1,016 offices. Today delivery is available virtually throughout the nation, on a next-day or second-day basis.

There are preparation requirements similar to other classes. In the case of Express Mail, the piece must be large enough to hold the required labels and indicia on a single side, and at the other extreme be not more than 108 inches in length plus girth. There are five basic domestic service offerings. They include Express Mail: Same Day Airport Service (formerly called Airport to Airport), Custom Designed Service, Next Day Service, Second Day Service, and Military Service. Second Day service, rather than being a reduced service standard, is service to addresses not served by the Next Day network. Express Mail Second Day was a new service addition approved in the 1987 general rate case. The current rate structure is divided into four categories: Same Day Airport, Custom Designed, Next Day and Second Day PO to Addressee, and Next Day and Second Day PO to PO. In 1998, ninety-nine percent (0.9860) of domestic Express

Mail Service was Next Day and Second Day PO to Addressee. The relative distribution of the other categories was of approximately: no Same Day Airport (the service is currently suspended), seven-tenths of one percent (0.0074) Custom Designed, and seven-tenths of one percent (0.0066) Next Day and Second Day PO to PO. For all of these groups the rate begins at pieces weighing less than or equal to one-half of one pound, then over one-half pound to two pounds, and then increases in one pound increments to 70 pounds. A flat-rate envelope was approved in the R90-1 general rate case. It is priced at the two-pound rate, regardless of actual weight, and comprises about one one-hundredth of one percent (0.00014) of Express Mail total volume. Under the proposal all of the services would remain. Witness Plunkett (USPS-T-36) presents the Postal Service's proposed rates.

2. Dynamic Nature of the Service

Through the decade of the 1980's, the expedited delivery industry has seen explosive growth and rapid change in technology. It continues to be a fiercely competitive industry. The real or inflation-adjusted price has fallen, and the service has expanded as well as improved through the period we observed. The industry has grown from one providing an elite service to a few for critical or emergency situations, to one where some mailers almost routinely send "important" items "Express". Now it is not unusual to see mail-order catalogs and others offering the service as a routine extra-charge option. Because of these rapid changes, both the industry as a whole, and Express Mail as one of the competitors, are not the same today as when the Express Mail service began in the

late 1970's. One can reasonably expect the industry to change in the future as well. It will probably change in unexpected ways that will depend on the innovation and the creativity of the competitors. The spectacular growth in facsimile (FAX), the Internet, and other electronic communications media could also be factors in the future of this industry.

We were not able to include all of these influences in our model. Our work is the fourth presentation of econometrically estimated elasticities. One consequence of this is the tentative nature of our results. Even though we have tried to be as comprehensive as possible in modeling this service, changes have occurred and are likely to continue to occur very rapidly. Those changes could significantly alter the results of future research.

Regression files for the Express Mail models are contained in Library Reference I-112, Section D. Volume forecast multipliers for Express Mail are in I-113, Section B, and the forecasts are in Section C. (For a general discussion of volume multipliers see testimony of witness Tolley, USPS-T-6, Technical Appendix.)

B. Volume Changes to Date

Table 6 shows the annual data for Express Mail volume[3]. Over the period, PFY1980 to PFY1999, volume increased by 292 percent (292.0), and the per adult increase was 206 percent (206.8). Over the last five years, PFY1994 to PFY1999, Express Mail volume increased by twenty-two percent (0.224), and on a per adult basis volume increased by seventeen percent (0.169). Express Mail also experienced volume growth over the last three years of twenty percent (0.197) from PFY1996 to PFY1999.

[3] As in the case of Priority Mail, PFY stands for the Postal Fiscal Year comparison period. For example, PFY1999 would mean the four postal quarters 99:1-99:4.

TABLE 6

EXPRESS MAIL
Volume*

Postal Qtrs	Volume (Millions)	Pieces per Adult
80:1 - 80:4	17.439	0.119
85:1 - 85:4	43.813	0.275
90:1 - 90:4	58.449	0.344
91:1 - 91:4	57.732	0.336
92:1 - 92:4	52.889	0.304
93:1 - 93:4	52.199	0.296
94:1 - 94:4	55.861	0.314
95:1 - 95:4	56.735	0.315
96:1 - 96:4	57.124	0.314
97:1 - 97:4	62.914	0.343
98:1 - 98:4	66.129	0.357
99:1 - 99:4	68.366	0.367

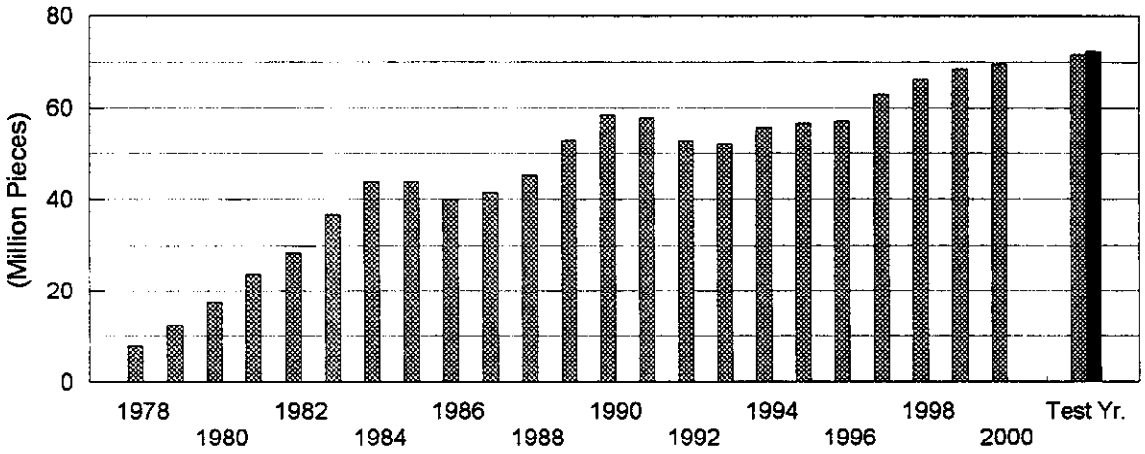
Growth Rates

BY Period	Volume	Pieces per Adult
1980 - 1985	151.2%	130.3%
1985 - 1990	33.4%	25.0%
1990 - 1995	-2.9%	-8.4%
1995 - 1999	20.5%	16.3%
1980 - 1999	292.0%	206.8%
1990 - 1999	17.0%	6.6%
1991 - 1994	-3.2%	-6.6%
1994 - 1999	22.4%	16.9%
1996 - 1999	19.7%	16.7%

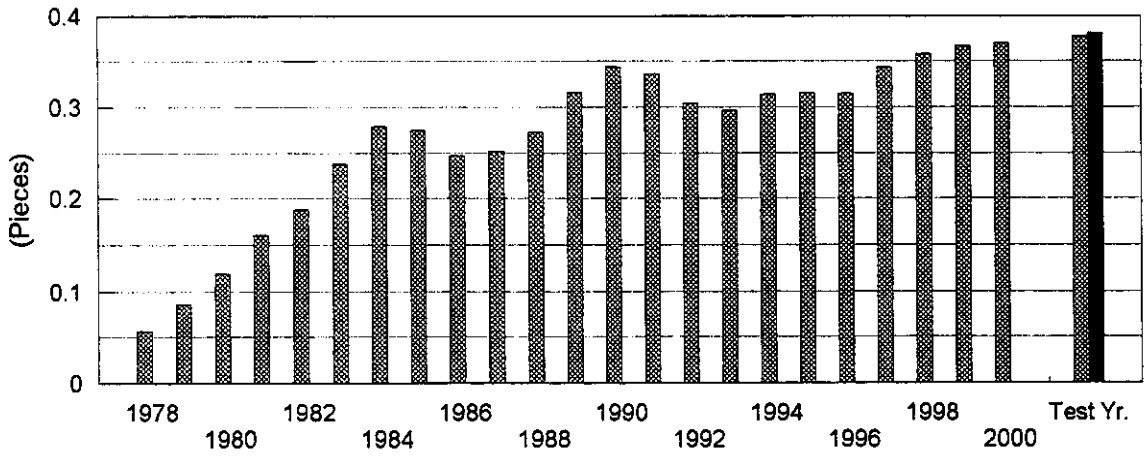
* Agency and Franked Mail Distributed except for the period 1986:1 - 1987:4.

FIGURE 2. HISTORICAL AND FORECAST EXPRESS MAIL VOLUME

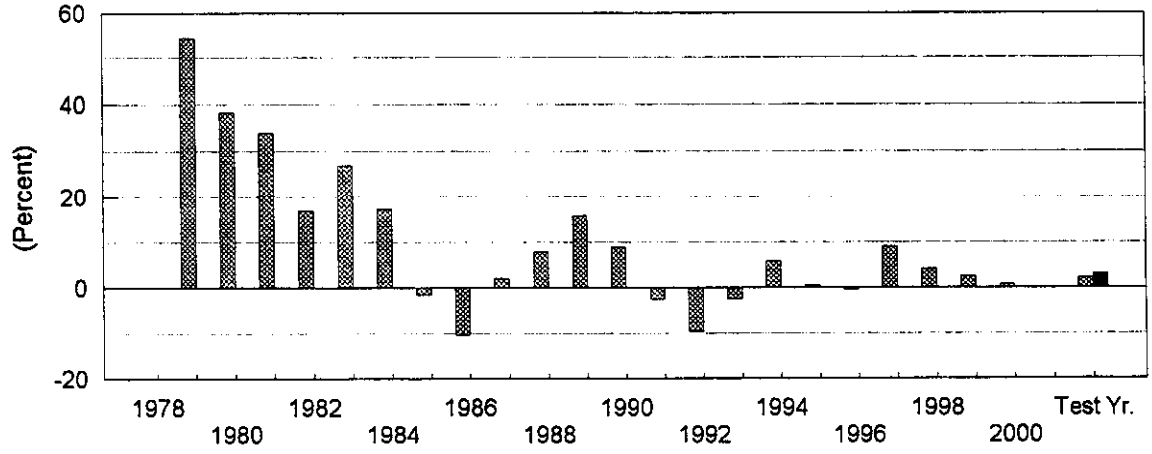
A. Total Volume



B. Volume Per Adult



C. Percent Change in Volume Per Adult



Before Rates After Rates

Test Year: GFY 2001

On a per adult basis, the growth was 16.7 percent (0.36652/0.31418=0.16659) from PFY1996 to PFY1999. However, as Table 6 displays, some periods show volume declines. These results are indicative of the volatility of this market. Additional historical volume changes of Express Mail are also illustrated in Figure 2 along with the Test Year before and after rates volumes.

C. Changes to the Model

1. No Fundamental Changes

There were no fundamental changes to the Express Mail model as presented in the R97-1 general rate case. The changes which were made were generally in the areas of improving the measurement of the influence of seasons and we added a measure of the impact of the 1997 UPS strike.

a. Seasonal Patterns

As in the case of Priority Mail, a pattern of moving seasonal fluctuations in Express Mail volumes was found to exist in the previous general rate case, R97-1. To account for this pattern of seasonal influences we used a statistical technique called X-11. The computer program we used was from the national statistics office of Canada called Statistics Canada but was not Y2K compliant. While they promised to have a revised version of their program, we decided to account for the moving seasons with binary variables in the econometrics software we use to estimate the model itself.

Christmas is an important season for Express Mail. In 1981 and earlier calendar years, Christmas Day fell in the first postal quarter. In calendar 1982, Christmas Day became the first day of postal quarter two of postal fiscal 1983. Since then, the number

of days prior to Christmas, in postal quarter two, has increased. The second quarter of postal fiscal year 1999 began on December 5, 1998 and thus included 15.5 pre-Christmas days (Sundays are not counted and Saturdays are counted as half days). Due to the migration of Christmas Day from postal quarter one to quarter two, the amount of Christmas Express Mail has moved from postal quarter one to quarter two. As explained in Technical Appendix B, we defined the pre-Christmas period to be December 1 through December 23 and the post-Christmas period to be December 24 through January first. Both variables had the expected signs indicating more mail in the pre and less mail in the post-Christmas season. These variables are combined with the postal quarter variables to obtain the moving season impact index (see Technical Appendix B). The index is used to account for the effect of the moving seasonal pattern (see section D.5 below).

b. UPS Strike

From August 4,1997 to August 19,1997, United Parcel Service Teamsters employees were on strike. According to the Department of Labor, 185,000 UPS employees were on strike. It was a major strike influencing all of the U.S. package shipping industry. Because the strike was considerably larger than other UPS strikes we decided to model it as a separate economic event. The influence of added volume due to this strike was captured in the Express Mail model by using a binary variable with a value of unity for 1997.4. In addition, it was assumed that there could be increases in volume for the three subsequent quarters generally decreasing over the four quarters following the strike. The results indicate that the strike impact followed this pattern with smaller additional volume in the second and third quarters following the strike (see Section D.6).

c. Logistic Growth Variable

The rapid growth in the industry in the early years, and the possibility of slower growth in the future suggested the logistic growth approach. The Z-variable method is used in the model now and was also used in the in the R94-1 and R97-1 models (see Technical Appendix C and section D.8).

d. Priority Mail Price

The cross-price index of Priority Mail was added to the model in the R94-1 and was also used in the R97-1 rate case. From our statistical results, the Priority Mail cross-elasticity is significant and continues to be an economic substitute for Express Mail.

e. Federal Express Average Revenue

The average revenue of Federal Express' domestic service (called package yield) was also added to the model in R94-1 and also used in the R97-1 rate case. The Federal Express estimated cross-price elasticity is statistically significant. The result is that Federal Express appears to continue to offer services that are competitive with Express Mail services (see section D.4).

f. Long-run Income

In 1995 the Department of Commerce made changes to the methods it uses to measure the level of national economic activity. Several of those changes resulted in revisions to the government' s historical data. The new series we use is based on the revised Department of Commerce data on personal consumption expenditures on nondurables to compute the value for long-run or permanent income. It is the same series we used in the R97-1 rate case.

D. Factors Affecting Volume

1. Price

The real or inflation-adjusted weighted price index for Express Mail has declined from about fourteen dollars ($14.141) in Postal Fiscal Year 1980 to thirteen dollars ($13.116) in PFY1988 and then to twelve dollars ($12.005) in PFY1999. The index is based on constant 1992 dollars. The decrease in the inflation adjusted price of Express Mail is about 15 percent (-0.1511) from 1980 to 1999. This decrease in the real price of the service represents an important reason why the volume expanded in the 1980 to 1999 period.

The econometrics models include the current period and three periods of lags for inflation adjusted price changes. The estimated elasticity of the own-price variable has the expected negative sign, and is statistically significant with an estimated t = -20.385.

The results, which are presented in Table 7, estimate that the long-run own-price elasticity for Express Mail is approximately equal to -1.57 (-1.565).[4] This means that one would expect about a 2.5 percent (-0.0248) decrease in volume from PFY1994 to the 1999 base period, as the result of the 1.6 percent (0.0158) increase in real price, holding all the other factors constant. A 2.2 percent (0.0218) increase in volume from PFY1996 to PFY1999 would be due to the 1.4 percent (-0.0139) decrease in real price over the last three years, holding all of the other influences constant. Factors other than price are important.

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[4] Our results, as in R94-1 and R97-1, continue to be consistent with Professor Kahn's testimony in Docket No. RM88-2. Using his terminology, our long-run own-price elasticity would be called "Brand" elasticity. (See Direct Testimony of A.E. Kahn on behalf of USPS, USPS-T-2, Page 21.)

TABLE 7
EXPRESS MAIL
Econometric Results

Dependent Variable DVOLEM_Z - Estimation by Restricted Regression
Quarterly Data From 1980:01 To 1999:04

Usable Observations	80	Degrees of Freedom	57
Centered R**2	0.955813	R Bar **2	0.938758
Uncentered R**2	0.999973	T x R**2	79.998
Mean of Dependent Variable			-2.733021045
Std Error of Dependent Variable			0.067867492
Standard Error of Estimate			0.016795205
Sum of Squared Residuals			0.0160784979
Durbin-Watson Statistic			1.751621
Q(19-0)			8.648147
Significance Level of Q			0.98663584

	Variable	Coeff	Std Error	T-Stat	Signif
1	DUNT	-7.6641333	0.410133972	-18.6869	0
2	DEMFWUI	-0.5293056	0.090494712	-5.84902	2.5000000E-07
3	DEMFWUI{1}	-0.5036238	0.076720114	-6.56443	2.0000000E-08
4	DEMFWUI{2}	-0.3089152	0.07361634	-4.19629	0.000096
5	DEMFWUI{3}	-0.2235734	0.070913515	-3.15276	0.00257931
6	DEMFWUI{4}	0	0	0	0
7	DYPCN	2.44970357	0.175007394	13.99771	0
8	DPX8	0.15439233	0.081060434	1.90466	0.06187511
9	DPX8{1}	0.14222655	0.043678612	3.25621	0.00190339
10	DPX8{2}	0.14172839	0.048853683	2.90108	0.00527621
11	DPX8{3}	0.1037628	0.047896326	2.1664	0.03447577
12	DP X8{4}	0	0	0	0
13	DFEDQAR	0.06658234	0.103922911	0.64069	0.5242918
14	DFEDQAR{1}	0.07211567	0.105002677	0.6868	0.49499449
15	DFEDQAR{2}	0.13978808	0.10074191	1.38759	0.17066412
16	DFEDQAR{3}	0.02764002	0.096514166	0.28638	0.77562311
17	DFEDQAR{4}	0	0	0	0
18	DDUPSSTK	0.10076522	0.017937276	5.61764	6.0000000E-07
19	DDUPSSTK{1}	0.04577222	0.018317489	2.49883	0.01536683
20	DDUPSSTK{2}	0.03315374	0.018085395	1.83318	0.07199997
21	DDUPSSTK{3}	0.03312238	0.015654995	2.11577	0.03874523
22	DDUPSSTK{4}	0	0	0	0
23	DFL	-0.0535112	0.007838936	-6.82633	1.0000000E-08
24	DWT	0.02019102	0.012830888	1.57363	0.12110869
25	DSP	0.04470436	0.005276169	8.47288	0
26	DDEC1_23	0.23809308	0.03177087	7.49407	0
27	DEC24_JAN1	-0.3369297	0.155918259	-2.16094	0.03491592

TABLE 7 (Continued)
EXPRESS MAIL
Econometric Results

SHILLER SMOOTHNESS PRIORS	
Own Price	K = 0.002
Priority Mail cross price	K = 0.029
Federal Express cross price	K = 0.001
UPS strike of 1997:4	K = 0.114

Data Legend

DVOLEM_Z	Express Mail quarterly volume per accounting period per adult less the Z-variable.
DUNT	Constant term.
DEMFWUI	Express Mail price index deflated by personal consumption expenditures price deflator (chained).
DSI	Seasonal index.
DYPCN	Real permanent income per adult based on personal consumption expenditures on nondurable goods.
DPX8	Priority Mail price index deflated by personal consumption expenditures price deflator (chained).
DFEDQAR	Federal Express Corporation's average revenue deflated by perso consumption expenditures price deflator (chained).
DUPSSTK	Binary variable for UPS strike in 1997:4.
DFL	Binary variable for Fall.
DWT	Binary variable for Winter.
DSP	Binary variable for Spring.
DDEC1_23	Proportion of business days in a quarter between December 1, and December23 inclusive.
DDEC24_JAN1	Proportion of business days in a quarter between December 24, and January 1 inclusive.

The prefix "D" indicates variables have been transformed for autocorrelation correction.

2. Long-run Income based on nondurables

One would expect the estimated coefficient of this variable to have a positive sign. Our estimated permanent income elasticity for Express Mail service is positive with a value of 2.45, and is statistically significant. From PFY1994 to PFY1999 per adult (inflation adjusted) permanent income, based on personal consumption expenditures on nondurables, increased 9.7 percent (0.0971), and from PFY1996 to PFY1999 it increased by about seven percent (0.0699). Over the three year period, the increase in Express Mail volume totaled approximately 17.1 percent (0.1712) in PFY 1999 compared to PFY1996 and over the longer five year period it was 23.8 percent (0.2378) higher in 1999 than in 1994, due to the growth in long-run income, holding all the other influences constant.

3. Priority Mail

For some customers, Priority Mail is an economic substitute for Express Mail. As such, we would expect the sign of the coefficient of Priority Mail price to be positive. We included the current period and three lag periods reflecting the inflation adjusted price index. Priority Mail price has an impact on Express Mail volume. Its estimated elasticity is 0.542 and is statistically significant.

Over the five-year period, from PFY1994 to PFY1999 the weighted average real price of Priority Mail decreased by 2.2 percent (-0.0224). That decrease resulted in a decrease in Express Mail volume of about 1.2 percent (-0.0122). Over the three years, from PFY1996 to PFY1999, the fixed-weight index for Priority Mail prices decreased by 1.8 percent (-0.0178), resulting in a one percent (-0.0096) decrease in Express Mail

volume, holding all other influences constant.

4. Federal Express Average Revenue

A leading provider of substitute services for Express Mail is The Federal Express Corporation. We use data on the firm's total domestic express operating results. The data we use are called yield per package, and can be thought of as average revenue per piece. We include the current and three lags of this variable as a measure of the competitor's price.

The estimated cross-price elasticity is 0.306, and is statistically significant. Over the period from PFY1994 to PFY1999 the decrease in the weighted average inflation adjusted Federal Express price was approximately 10 percent (-0.1002). With a cross-price elasticity of 0.306, the resulting decrease in Express Mail is 3.1 percent (-0.0307). Over the three year PFY1996 to PFY1999 period, the weighted average Federal Express real price decreased 0.2 percent (-0.0021), and accounted for a decrease in Express Mail volume of approximately 0.06 percent (-0.0006), holding all the other factors constant.

5. Seasonal Patterns

As explained above, the Pre and Post-Christmas variables are combined with the postal quarter variables to obtain the moving season impact index (see Technical Appendix B). Table 8 of partial autocorrelations shows the residual pattern after the moving seasons process is completed. Based on that table, the Durbin-Watson statistic and the autoregression diagnostic regressions in Library Reference I-112, Section B pages 85-87, an autocorrelation correction was necessary. AR(1) was used. Table 9 and the Durbin-Watson statistic in Table 7 indicate that no further autocorrelation

adjustments are necessary. The impacts of the moving seasons adjustments are converted to seasonal factors in the forecasts. The method of computing these factors is shown in Technical Appendix B and is the same as that used in Priority Mail. While the index values are much the same from year to year, over a longer period the changes are larger. For example in PFY1994 the seasonal values were Fall = 0.9659, Winter = 1.0185, Spring = 1.0325, and Summer = 0.9873 and by PFY2000 the values are Fall = 0.9461, Winter = 1.0392, Spring = 1.0321, and Summer = 0.9870. When the quarterly values are weighted by the number of accounting periods in the quarter (3/13, 3/13, 3/13 and 4/13), the values sum to one indicating that the index allocates the moving season impact within the postal fiscal year. See Technical Appendix B.

6. UPS Strikes

When strikes occur in the parcel delivery industry, it is plausible that the volume in Express Mail would increase. That is, if UPS service were not available or if strike activity increased the risk of delay in UPS shipments, some customers would shift to Express Mail.

In 1997, according to the Department of Labor, approximately 185,000 UPS workers were on strike from August 4 to August 19,1997. The large strike resulted in increased Express Mail volume. Our model indicates that the added volume due to the strike was approximately 3.6 (3.635) million pieces. Our forecasts assume that no strikes will take place in the Test Year. Therefore, Express Mail volume would not be increased by UPS strikes in the Test Year.

TABLE 8

Express Mail

Prior to estimation subject to lag structure restrictions

PARTIAL AUTOCORRELATIONS AND 95 % CI AROUND ZERO

LAG	LOWER BOUND	PAC*	UPPER BOUND	SIGNIFICANT
0	0.0000	1.0000	0.0000	0
1	-0.2236	0.4581	0.2236	1
2	-0.2250	0.0889	0.2250	0
3	-0.2265	-0.0952	0.2265	0
4	-0.2279	-0.1403	0.2279	0
5	-0.2294	-0.1474	0.2294	0
6	-0.2309	0.0515	0.2309	0
7	-0.2325	-0.0357	0.2325	0
8	-0.2341	-0.0840	0.2341	0
9	-0.2357	-0.1620	0.2357	0
10	-0.2374	-0.0410	0.2374	0
11	-0.2390	0.0040	0.2390	0
12	-0.2408	-0.1361	0.2408	0
13	-0.2425	0.0740	0.2425	0
14	-0.2443	-0.0727	0.2443	0
15	-0.2462	0.0933	0.2462	0
16	-0.2481	-0.0870	0.2481	0
17	-0.2500	0.0368	0.2500	0
18	-0.2520	-0.0450	0.2520	0
19	-0.2540	-0.0779	0.2540	0

*Partial Autocorrelation Coefficient

TABLE 9

Express Mail

Final Estimates

PARTIAL AUTOCORRELATIONS AND 95 % CI AROUND ZERO

LAG	LOWER BOUND	PAC*	UPPER BOUND	SIGNIFICANT
0	0.0000	1.0000	0.0000	0
1	-0.2250	0.1170	0.2250	0
2	-0.2265	0.0822	0.2265	0
3	-0.2279	0.0221	0.2279	0
4	-0.2294	-0.0177	0.2294	0
5	-0.2309	-0.0932	0.2309	0
6	-0.2325	0.0361	0.2325	0
7	-0.2341	0.0061	0.2341	0
8	-0.2357	-0.0512	0.2357	0
9	-0.2374	-0.0128	0.2374	0
10	-0.2390	-0.0235	0.2390	0
11	-0.2408	-0.0190	0.2408	0
12	-0.2425	-0.1208	0.2425	0
13	-0.2443	0.0323	0.2443	0
14	-0.2462	-0.1232	0.2462	0
15	-0.2481	0.1068	0.2481	0
16	-0.2500	-0.0923	0.2500	0
17	-0.2520	0.0320	0.2520	0
18	-0.2540	0.0730	0.2540	0
19	-0.2561	0.0103	0.2561	0

*Partial Autocorrelation Coefficient

7. Adult Population

In the five-year period PFY1994 to PFY1999, the adult population (males and females 22 years of age and over) grew by 4.7 percent (0.0468). From PFY1996 to PFY1999 the increase was 2.6 percent (0.0259). Our dependent variable, quarterly per accounting period Express Mail volume, is divided by the adult population. To compute the total volume from per adult volume, one simply multiplies per adult volume by the adult population. Population growth translates to an approximately five percent (0.0468) increase in Express Mail volume through the PFY1994 to FYP1999, and an approximately three (0.0259) percent increase from PFY1996 to the base period PFY1999.

8. Logistic Growth Variable

Rapid growth in Express Mail volume during much of the sample period suggested that a logistic term should be used. The term would allow for market penetration as well as market maturation. The Z variable method we used is the same approach as first used in R87-1, and also in R90-1, R94-1 and R97-1. The approach is implemented in the same two-step process as in my previous testimony. (For a discussion of the Z variable approach see witness Thress (USPS-T-7), Section III.) The implementation of the variable is in my Library Reference I-112, Section B, pages 79-82.

As in R97-1, the Z variable has a relatively small impact on forecasted Express Mail volume. From PFY1994 to PFY1999 it increases volume by about three ten-thousands of one percent (0.000003). From PFY1996 to PFY1999 the variable has the impact of increasing volume by 0.00004 percent (0.0000004).

E. Volume Forecasts

1. R97-1 Forecast Accuracy

In the response to an interrogatory (UPS/USPS-T8-4) in R97-1, we replied that the forecasts of Express Mail volume were expected be in the range of plus or minus 7 percent of the actual value. The forecast for PFY1998 was 64.228 million pieces and the actual volume was 66.128 million pieces, an error of 2.9 (0.0287) percent. When the actual values for the right-hand side variables are used, the forecast would be 64.625, an error of 2.3 (0.0227) percent. This very close forecast does not alter our view that future forecasts generally should be in the plus or minus 7 percent range.

2. Test Year Forecasts

Because the increase in Express Mail price is small (3.82 percent) compared to the increase in Priority Mail price (15.06 percent), the own-price effect that reduces volume is off-set by the larger cross-price effect that increases volume. For example in 2002:1, volume increases from 15.832 million pieces in the before-rates environment to 16.110 million pieces in the after-rates environment, an increase of approximately 1.8 percent (0.0176). This final result comes from the own-price increase of 3.82% applied to the elasticity of -1.565, ($(1.03816376^{-1.565418}) = 0.943055$) decreasing volume by about 6 percent. And the cross-price increase of 15.06% applied to the elasticity of 0.542, ($(1.15064695^{0.5421101}) = 1.079039$) increasing volume by about 8 percent. The two effects result in the increase volume of about 1.8 percent (0.943055*1.079039 = 1.017593).

Projecting the influences of own price, cross prices, long run income, and population, results in a projection of 72 million (71.641) pieces of Express Mail for the

Test Year beginning October 1, 2000, if present postal rates are continued (before-rates forecast). If the rates recommended by the Postal Service are adopted, the forecast is 72 million (72.301) pieces of Express Mail (after-rates forecast).

TECHNICAL APPENDIX A

UPS Person Days Lost Due to Strikes

One of the important economic influences upon Priority Mail is the availability of competing services. When competing services are not available, or the availability is reduced, we would expect more Priority Mail volume. When a strike occurs at United Parcel Service (UPS) we would expect Priority Mail to increase, and our statistical results are consistent with that expectation.

There are many quarters with no strike activity at UPS. The data contains zeros for those periods. A double log model is usually not appropriate in such a situation. To see this, and to see the model that we actually used, we will write a simplified version of the double-log model and our model. We will reduce the number of variables, simplify the notation and omit the discussion of the stochastic specification of the model. None of these issues would compromise our explanation; we only simplify the issues for clarity.

Our symbols are:

V = Volume
X = non-zero explanatory variable
S = Strike data which contain some zeros
a, b, c = parameters to be estimated.

The double log model is derived from equation (1):

$$\mathbf{V} = a\mathbf{X}^{b}, \qquad (1)$$

which becomes:

$$\ln(V) = \ln(a) + b \ln(X) \quad . \tag{2}$$

If we simply added S, we would have

$$V = aX^b S^c \quad \text{, or:} \tag{3}$$

$$\ln(V) = \ln(a) + b \ln(X) + c \ln(S) \, . \tag{4}$$

Equation (3) would imply that Priority Mail would be zero when UPS had no strikes. That is, zero to any non-zero power is zero. If we attempted to use equation (4) we would find it impossible, since the logarithm of zero is undefined.

The model we constructed is analogous to equations 5 and 6 below:

$$V = aX^b e^{cS} \tag{5}$$

$$\ln(V) = \ln(a) + b \ln(X) + c S \quad . \tag{6}$$

As can be seen, the model continues to be linear in the parameters which are to be estimated. The only complication is that the coefficient c is no longer an elasticity.

In equation (2) or (6) it can be shown that the elasticity of V with respect to X is

$$\eta_x = \partial V/\partial X * X/V = \partial \ln(V)/\partial \ln(X) = b \quad . \tag{7}$$

However, the elasticity of **V** with respect to **S** is not equal to c. Simple calculus shows that the elasticity is

$$\eta_s = \partial V/\partial S * S/V = c S \quad . \tag{8}$$

This is obtained by first taking the total differential of equation (6) which is:

$$d \ln (V) = d \ln(a) + \partial \ln(V)/\partial \ln(X) \, d \ln(X) + \partial \ln(V)/\partial S \, dS \tag{9}$$

from equation (6) $\partial \ln(V)/\partial S = c$, and from equation (7) $\partial \ln(V)/\partial \ln(X) = b$.

Since $d \ln (V) = (1/V) \, dV$ equation (9) becomes

$$(1/V) \, d(V) = 0 + b(1/X) \, d(X) + c \, d(S) \quad . \tag{10}$$

Holding X constant and rearranging terms results in

$$\mathbf{1/V} * \partial \mathbf{V}/\partial \mathbf{S} = \mathbf{c} \qquad (11)$$

and multiplying both sides by **S** results in our elasticity

$$\eta_s = \mathbf{S/V} * \partial \mathbf{V}/\partial \mathbf{S} = \mathbf{c\ S} \quad , \qquad (12)$$

which is the answer. The elasticity is no longer a constant. The elasticity of **S** varies as **S** varies.

To see how these elasticities vary over time we computed the elasticity for each of the years with UPS strike activity. They are presented in the table below.

TABLE WPA-1

PFY	UPSMDLS (00,000)	COEFFICIENT	ELASTICITY
1970	1.18234	0.0231961	0.0274
1971	0.84276	0.0231961	0.0195
1972	0.42	0.0231961	0.0097
1973	0.11606	0.0231961	0.0027
1974	1.98626	0.0231961	0.0461
1975	1.66077	0.0231961	0.0385
1976	4.6129	0.0231961	0.1070
1977	6.29719	0.0231961	0.1461
1980	0.07217	0.0231961	0.0017
1981	0.147	0.0231961	0.0034
1982	0.25	0.0231961	0.0058
1994	0.40	0.0231961	0.0093

TECHNICAL APPENDIX B

Seasonality

In the R97-1 models we modeled seasonality in Priority Mail and Express Mail models using the quarterly dummies and seasonal component of the residuals obtained from the X11-ARIMA program of Statistics Canada. The X11-ARIMA program was not year 2000 compliant. In order to avoid possible bugs we used an alternate method of modeling seasonality.

The Postal Service's Fiscal calendar is made up of 13 accounting periods of 28 days each. The Postal Service's Fiscal calendar is divided into 4 quarters. The first three quarters consist of 3 accounting periods each. The fourth quarter is made up of 4 accounting periods. Because of this, the Postal Service's Fiscal calendar is made up of 364 days and does not change in leap years. Thus, the beginning of the Postal Fiscal year as well as the beginning of each postal quarter, shifts over time. The Postal Fiscal year begins in the Fall. Postal Fiscal year 1970 began on October 18, 1969. Postal Fiscal year 1999 began on September 12, 1998.

Due to the movement of the Postal quarters within the Gregorian calendar, relative quarterly mail volume changed over time. Mail volumes prior to Christmas are expected to be high. Prior to calendar year 1982, Christmas Day fell in the first Postal quarter. The second Postal quarter of Postal Fiscal year 1983 started on Christmas Day of the calendar year 1982. From Postal Fiscal year 1983, the number of days prior to Christmas Day in the second Postal quarter has been gradually increasing. The second quarter of Postal

Fiscal year 1999 began on December 5, 1998 and thus included 15.5 days prior to Christmas Day (Business days exclude Sundays and count Saturdays as half days). Due to the migration of Christmas Day from the first Postal quarter to the second Postal quarter, the Christmas mail volume shares have changed between the first Postal quarter and the second Postal quarter. This migration of Christmas mail from the first Postal quarter to the second Postal quarter is due to the Postal Services moving calendar. So even if the seasonal variation in mail volume is constant, in the Gregorian calendar, it may not be constant in Postal quarters.

RCF created a set of seventeen seasonal variables. These seasonal variables are constructed so that for any given quarter, the value of the seasonal variable is set equal to the proportion of business days within the quarter that fall within the quarter of interest. A detailed description of these variables is provided in USPS witness Thomas Thress R97-1 testimony USPS-T-7 pp 125-7.

We experimented with these seasonal variables in the Priority Mail and Express Mail models. However, we found that most of the estimated coefficients of these seasonal variables were of unexpected sign. In our model we used the quarterly fixed seasonal dummies for Fall, Winter, Spring, and two additional seasonal variables to capture the moving Christmas Day effect. The two additional seasonal variables were constructed in the same way as RCF's seasonal variables. The first seasonal variable covered the period from December 1 through December 23, while the second seasonal variable covered the period from December 24 through January 1. The estimated coefficients of these two seasonal variables had the expected sign. The first seasonal variable covering the period

prior to Christmas Day was positive as expected, and statistically significant in both Priority Mail and Express Mail models. The second seasonal variable covering the period from a day before Christmas Day to the first day of January was negative as expected and statistically significant in both Priority Mail and Express Mail models.

The estimated effects of the three seasonal dummies and the two seasonal variables are combined into a single seasonal index by Postal quarters. The method of computing this index is described in detail below:

Step 1: Multiply the estimated coefficients by the value of the variables and sum across each quarter. For example, the estimated coefficient and the values of the variables in the Priority Mail model are:

	FALL	WINTER	SPRING	DEC1_23	DEC24_JAN1
Coefficients	0.0530565	0.0805145	0.0870260	0.3450482	-0.7232420
Values					
1997:1	1.000000	0.000000	0.000000	0.078125	0.000000
1997:2	0.000000	1.000000	0.000000	0.195313	0.085938
1997:3	0.000000	0.000000	1.000000	0.000000	0.000000
1997:4	0.000000	0.000000	0.000000	0.000000	0.000000
1998:1	1.000000	0.000000	0.000000	0.078125	0.000000
1998:2	0.000000	1.000000	0.000000	0.210938	0.085938
1998:3	0.000000	0.000000	1.000000	0.000000	0.000000
1998:4	0.000000	0.000000	0.000000	0.000000	0.000000

The sum of the product of the coefficients and variables gives

1997:1	0.080013	This equals	0.053*1 + 0.081*0 + 0.087*0 + 0.345*0.078 - 0.723*0.0	
1997:2	0.085753	This equals	0.053*0 + 0.081*1 + 0.087*0 + 0.345*0.195 - 0.723*0.086	
1997:3	0.087026	This equals	0.053*0 + 0.081*0 + 0.087*1 + 0.345*0.0 - 0.723*0.0	
1997:4	0.000000	This equals	0.053*0 + 0.081*0 + 0.087*0 + 0.345*0.0 - 0.723*0.0	
1998:1	0.080013	This equals	0.053*1 + 0.081*0 + 0.087*0 + 0.345*0.078 - 0.723*0.0	
1998:2	0.091144	This equals	0.053*0 + 0.081*1 + 0.087*0 + 0.345*0.211 - 0.723*0.086	
1998:3	0.087026	This equals	0.053*0 + 0.081*0 + 0.087*1 + 0.345*0.0 - 0.723*0.0	
1998:4	0.000000	This equals	0.053*0 + 0.081*0 + 0.087*0 + 0.345*0.0 - 0.723*0.0	

Step 2: Take the anti-log of the above series

1997:1	1.083302	This equals	EXP(0.080013)
1997:2	1.089537	This equals	EXP(0.085753)
1997:3	1.090925	This equals	EXP(0.087026)
1997:4	1.000000	This equals	EXP(0.000000)
1998:1	1.083302	This equals	EXP(0.080013)
1998:2	1.095427	This equals	EXP(0.091144)
1998:3	1.090925	This equals	EXP(0.087026)
1998:4	1.000000	This equals	EXP(0.000000)

Step 3: Compute the weighted values of the index using number of business days as the weights.

		Business Days in Quarter	Business Days in PFY		
1997:1	0.248499	64	279	This equals	1.083302*64/279
1997:2	0.249930	64	279	This equals	1.089537*64/279
1997:3	0.258068	66	279	This equals	1.090925*66/279
1997:4	0.304659	85	279	This equals	1.000000*85/279
1998:1	0.248499	64	279	This equals	1.083302*64/279
1998:2	0.251281	64	279	This equals	1.095427*64/279
1998:3	0.258068	66	279	This equals	1.090925*66/279
1998:4	0.304659	85	279	This equals	1.000000*85/279

Step 4: Compute the weighted annual sum.

1997:1	1.061157	This equals	0.24850+0.24993+0.25807+0.30466
1997:2	1.061157	This equals	0.24850+0.24993+0.25807+0.30466
1997:3	1.061157	This equals	0.24850+0.24993+0.25807+0.30466

1997:4	1.061157	This equals	0.24850+0.24993+0.25807+0.30466
1998:1	1.062508	This equals	0.24850+0.25128+0.25807+0.30466
1998:2	1.062508	This equals	0.24850+0.25128+0.25807+0.30466
1998:3	1.062508	This equals	0.24850+0.25128+0.25807+0.30466
1998:4	1.062508	This equals	0.24850+0.25128+0.25807+0.30466

Step 5: Divide the values of the seasonal index from step 2 by the weighted annual sum from step 4.

1997:1	1.020869	This equals	1.08330/1.06116
1997:2	1.026745	This equals	1.08954/1.06116
1997:3	1.028053	This equals	1.09093/1.06116
1997:4	0.942368	This equals	1.00000/1.06116
1998:1	1.019570	This equals	1.08330/1.06251
1998:2	1.030983	This equals	1.09543/1.06251
1998:3	1.026745	This equals	1.09093/1.06251
1998:4	0.941169	This equals	1.00000/1.06251

Step 6: Since the forecasts are quarterly we need to adjust the index to reflect that quarters one, two and three have three accounting periods each, while quarter four has four accounting periods. So we compute the weighted values of the index using the number of accounting periods per quarter as the weights.

		Number of APs in quarter	Number of Aps in PFY		
1997:1	0.235585	3	13	This equals	1.020869*3/13
1997:2	0.236941	3	13	This equals	1.026745*3/13
1997:3	0.237243	3	13	This equals	1.028053*3/13
1997:4	0.289959	4	13	This equals	0.942368*4/13
1998:1	0.235285	3	13	This equals	1.019570*3/13
1998:2	0.237919	3	13	This equals	1.030983*3/13
1998:3	0.236941	3	13	This equals	1.026745*3/13
1998:4	0.289591	4	13	This equals	0.941169*4/13

Step 7: Compute the weighted annual sum.

1997:1	0.999728	This equals	0.23559+0.23694+0.23724+0.28996
1997:2	0.999728	This equals	0.23559+0.23694+0.23724+0.28996
1997:3	0.999728	This equals	0.23559+0.23694+0.23724+0.28996
1997:4	0.999728	This equals	0.23559+0.23694+0.23724+0.28996
1998:1	0.999736	This equals	0.23529+0.23792+0.23694+0.28959
1998:2	0.999736	This equals	0.23529+0.23792+0.23694+0.28959
1998:3	0.999736	This equals	0.23529+0.23792+0.23694+0.28959
1998:4	0.999736	This equals	0.23529+0.23792+0.23694+0.28959

Step 8: Divide the values of the seasonal index from step 5 by the weighted annual sum from step 7 to obtain the final values of the seasonal index.

1997:1	1.021146	This equals	1.02087/0.99973
1997:2	1.027024	This equals	1.02674/0.99973
1997:3	1.028332	This equals	1.02805/0.99973
1997:4	0.942624	This equals	0.94237/0.99973
1998:1	1.019839	This equals	1.01957/0.99974
1998:2	1.031255	This equals	1.03098/0.99974
1998:3	1.027016	This equals	1.02675/0.99974
1998:4	0.941418	This equals	0.94117/0.99974

This index shows the quarterly seasonal pattern and the change in seasonal pattern overtime. The values of the seasonal index in 1988 are:

1988:1	1.075744
1988:2	0.976595
1988:3	1.026456
1988:4	0.940904

So in 1988 the volume in the first postal quarter is the highest. It is no surprise as the first eighteen days of December are included in the first Postal quarter of 1988. As we move through the years the value of the index in 1998 is the highest in the second Postal quarter. Again this is no surprise as the second quarter of 1998 includes Postal volume from December 5, onwards. Thus the index clearly shows the transfer of Postal volume

from the first Postal quarter to the second Postal quarter over time. The advantage of using a seasonal index for forecasting Postal volumes is that the index reallocates the forecasts based on the seasonal pattern within each year and does not changes the volume from year to year. This can be seen by weighing each index value by the proportion of accounting periods in in the Postal quarter and summing the result. For example,

1997:1	0.235649	This equals	1.02115*3/13
1997:2	0.237005	This equals	1.02702*3/13
1997:3	0.237307	This equals	1.02833*3/13
1997:4	0.290038	This equals	0.94262*4/13
	1.000000	This equals	0.23565+0.23701+0.23731+0.29004
1998:1	0.235348	This equals	1.01984*3/13
1998:2	0.237982	This equals	1.03125*3/13
1998:3	0.237004	This equals	1.02702*3/13
1998:4	0.289667	This equals	0.94142*4/13
	1.000000	This equals	0.23535+0.23798+0.23700+0.28967
1988:1	0.248249	This equals	1.07574*3/13
1988:2	0.225368	This equals	0.97659*3/13
1988:3	0.236874	This equals	1.02646*3/13
1988:4	0.289509	This equals	0.94090*4/13
	1.000000	This equals	0.24825+0.22537+0.23687+0.28951

TECHNICAL APPENDIX C

Description of Logistic Growth Variable

Logistic growth is modelled as follows:

$$\frac{\alpha}{[1 + \beta^{*}EXP(-\delta^{*}T)]} + 10000^{*}(\alpha - ABS(\alpha)) + 10000^{*}(\beta - ABS(\beta)) + 10000^{*}(\delta - ABS(\delta))$$

where α, β, and δ are the parameters to be estimated, EXP is the symbol for exponential, ABS is the symbol for absolute value, and T indicates time. The parameter α represents the maximum adoption level, the parameter β represents the time it takes to reach the maximum adoption level, and the parameter δ reflects the rate of adoption. The rate of change of the dependent variable with respect to time is proportional to the current level of the dependent variable and also to the distance remaining to reach the maximum adoption level α. The parameters α, β, and δ must all be positive. The terms $1000^{*}(\alpha\text{-}ABS(\alpha))$, $1000^{*}(\beta\text{-}ABS(\beta))$, and $1000^{*}(\delta\text{-}ABS(\delta))$ are called the penalty functions. These functions vanish when convergence is attained and are used to ensure that the convergence occurs such that the positivity conditions hold.

This is a nonlinear expression and needs to be estimated using a nonlinear estimation technique. In practice this is handled in two stages. In the first stage, using a nonlinear least squares technique, an equation is estimated with a logistic trend term. From this equation the parameters of the logistic component of the model are used to

construct the market penetration variable called the Z-variable. The variable is simply the prediction from the equation using only the logistic component.

In the second stage the coefficient of the computed Z-variable is constrained to equal 1. This is achieved by subtracting the Z-variable from the dependent variable to obtain a new transformed dependent variable. The estimation then proceeds as usual but with the new transformed dependent variable. The final forecasts are retransformed by adding the Z-variable back to the forecasts from the model.

The statistical calculations are performed as a standard feature in the computer software system, "Regression Analysis of Time Series". They are invoked by using the "NONLIN" and "NLLS" commands producing the non-linear estimations via non-linear least squares as discussed above.

TECHNICAL APPENDIX D

Description of Choice Trail

The following choice trail leads from the R97-1 models to the R2000-1 models.

A. Priority Mail

1) The R97-1 model included a binary variable taking on a value equal to unity from 1991 quarter 3 onwards (DUPS), and the interaction of DUPS with four through eight lags of UPS prices. A separate Shiller smoothness parameter was estimated for lags four through seven (with eight being set to zero) of UPS prices interacted with DUPS. The sum of the estimated coefficients of UPS price lags four through seven interacted with DUPS was 1.143. In recent years UPS has been increasing its inflation adjusted prices less rapidly than in the past. UPS inflation adjusted fixed-weight index increased on the average by 7.2 percent from 1990 to 1995. From 1995 to 1999 the UPS inflation adjusted fixed-weight index increased on the average by 3.0 percent. In view of these smaller increases in the UPS fixed-weight price index, it was decided to use the current and four lags of UPS fixed-weight price index interacted with DUPS instead of four through eight lags of UPS prices. Also, UPS workers went on strike on August 4, 1997 through August 19, 1997. This was a major strike and it disrupted the package shipping industry. The influence of this pervasive strike by UPS workers was captured in the

Priority Mail model using a binary variable with a value of unity for 1997:4, instead of using the man-days lost due to strike variable. The sum of the estimated coefficients of UPS price lags zero through four interacted with DUPS was 1.26. The estimated own-price elasticity was -0.792 compared to -0.770 in R97-1.

2) Due to the nature of the Postal calendar, the Christmas season gradually moved from the first postal quarter to the second postal quarter. Prior to 1983, Christmas day fell in the first Postal quarter. Since 1983, Christmas day has fallen within the second Postal quarter. Moving from 1983 to 1999, the second Postal quarter gained more days in December, a period in which the mail volume is already high. To account for this moving seasonal pattern, an additional (Winter) dummy for the second quarter beginning in 1995 was added to the model. The estimated coefficients remained stable. The estimated own-price elasticity was -0.809 with the additional dummy for the second quarter compared to the estimated own-price elasticity of -0.801 without the dummy variable.

3) Billing determinants for GFY 1997 were obtained and the fixed-weight price indices were recomputed. The estimated coefficients remained stable. The estimated own-price elasticity decreased slightly in absolute magnitude from -0.809 to -0.796. Parcel Post cross-price elasticity became 0.105 compared to 0.104 using 1996 billing determinants-based fixed-weight price indices. The sum of the coefficients of UPS prices

became 1.426 compared to 1.435 using 1996 billing determinants-based fixed-weight price indices.

4) As mentioned earlier, the large-scale strike by UPS workers in August 1997 was at a national level and it caused a rippling effect through out the package industry. To account for the possible lingering effects of this strike, a dummy variable with four lags was used. The coefficients of the lags were estimated subject to Shiller Lags with the fourth lag being constrained to zero. The estimated own-price elasticity remained stable at -0.794.

5) We had modeled the moving seasonality using X11-ARIMA program of Statistics Canada and an additional dummy variable for the second quarter beginning in 1995. The X11-ARIMA program was not year 2000 compliant. To avoid possible bugs we used an alternate method of modeling seasonality. We tried using the seasonal variables developed by RCF. These variables are the proportion of business days in particular intervals of the Postal calendar. RCF divided the Postal calendar into seventeen intervals. Seventeen seasonal variable were thus created. When we used these variables in the Priority Mail model, many of the estimated coefficients had unexpected signs. In the case of Priority Mail the most pronounced seasonal effect is around Christmas. We modeled the seasonality using the seasonal dummies for Fall, Winter, Spring, and two additional seasonal variables to capture the influence of the moving

Christmas seasonality. The first seasonal variable, DEC1_23, is defined as the proportion of business days in a Postal quarter that fall in the period from December 1st to December 23rd inclusive. The value of Dec1_23 was 0.298 in 1970:1 and 0.0 for the remaining Postal quarters of 1970. This means that the 18.5 business days from December 1 to an including December 23 represent 29.8 percent of the 62 business days in 1970:1. (Business days exclude Sundays, seven holidays, and count Saturdays as half days). The value of Dec1_23 remained at 0.0 for Postal quarter two, three and four up to 1984. The value of Dec1_23 in Postal quarter 1985:1 was 0.2578 and in 1985:2 it was 0.0078. In 1999:1 the value of Dec1_23 declined to 0.0625 while in 1999:2 the value was 0.2266. By Postal fiscal year 2002 the value of Dec1_23 will be 0.0 in the first quarter and 0.266 in the second quarter. The second seasonal variable, DEC24_JAN1, measures the proportion of business days in a Postal quarter from December 24th to and including January 1st. This period is associated with relatively low volume. In 1970:1 the value of DEC24_JAN1 was 0.0887 and 0.0 for the remaining quarters of 1970. In 1984:1 the value of DEC24_JAN1 was 0.0 and in the second quarter the value was 0.0625. In 1999:2, DEC24_JAN1 took a value of 0.0859 and 0.0 for the remaining quarters of 1999. The Priority Mail model was estimated using the three fixed seasonal dummies: Fall, Winter, Spring, and the two additional seasonal variables described above. The

additional Winter seasonal dummy that was noted in section 2 above, and the seasonal component of the residuals from X11 were excluded. The estimated own-price elasticity remained stable at -0.799. The estimated coefficients of DEC1_23 and DEC24_JAN1 were statistically significant.

6) The Postal Service changed its methodology for collecting data. To be consistent with the new methodology, historical data were revised as far back as 1993. These revised data include Agency and Franked Mail volume. The model when estimated with the revised data produced a long-run own-price elasticity of -0.847, slightly higher in absolute magnitude.

7) Billing determinants for GFY 1998 became available. The fixed-weight price indices were calculated using the new GFY 1998 billing determinants. However, the Parcel Post fixed-weight price index was still based on 1997 billing determinants as Parcel Post 1998 billing determinants were not available. The Priority model was estimated with the new fixed-weight price index. The estimated long-run own-price elasticity was -0.864.

8) As a result of R97-1, the minimum weight requirement for a piece of First-Class Mail (FCM) to be classified as Priority Mail changed from 11 to 13 ounces. This change went into effect on January 10, 1999. The change in the minimum weight requirement has two effects. First, some pieces of Priority Mail weighing between 11 to 13 ounces transfer to FCM.

Second, as these low weight pieces transfer, the average revenue of the remaining pieces would rise. Thus, the price index needs to be adjusted to reflect the higher average revenue. To determine what percent of the low weight pieces transfer to FCM and to measure the impact on Priority Mail fixed-weight price index, the model is estimated in two steps. First, the Priority Mail fixed-weight price index is used assuming that there is no effect on the Priority Mail fixed-weight price index due to low weight pieces transferring to FCM. The estimated coefficient of the Volwt variable is used to obtain the multiplier for Volwt. The base value of Volwt is 11/12, the current value of Volwt is 13/12, the multiplier for Volwt is {(13/12)/(11/12)}^Volwt coefficient. The multiplier subtracted from 1 gives the percent of Priority Mail volume transferring to FCM. The billing determinants for pieces weighing up to one pound and Flat Rate envelopes are reduced such that the total PM billing determinants are reduced by the percent indicated by the multiplier. Using the adjusted billing determinants a revised Priority Mail price index is computed. This price index takes into account the higher average revenue due to low weight pieces transferring to FCM. Estimation of the model in this step indicated that about 9% of Priority Mail volume would transfer to FCM. In the second step the model is estimated using the unadjusted price index for before R97-1 and the adjusted price index for after R97-1. The value of the price index for the transition quarter is the weighted average of the

unadjusted price index and the adjusted price index. The weights are the proportion of days at the old rates and the proportion of days at the new rates. The estimated own-price elasticity remained stable at -0.866.

9) Monthly economic data are available before quarterly data. It was decided to use monthly economic data for all variables. Any historical or forecasts of exogenous variables from DRI, not available at monthly frequency, were converted to monthly data using DRI's linear conversion method. The estimated long-run own-price elasticity declined slightly in absolute magnitude to -0.834 compared to -0.866 when some of the data were at quarterly frequency.

10) We received revised Priority Mail volume data for Postal quarters 1999:1 - 1999:4. These revised volume data were used to construct the Priority Mail fixed weight-price index adjusted for the Priority Mail volume transferring to First-Class Mail. It was estimated that about 11 percent of the Priority Mail volume transferred to FCM. The revised fixed-weight price index was used to estimate the Priority Mail model. The estimated long-run own-price elasticity declined slightly in absolute magnitude from -0.834 to -0.819. This is the final model used.

B. Express Mail

1) UPS workers went on strike on August 4, 1997 through August 19, 1997. This was a major strike and disrupted the package shipping industry. The

influence of this pervasive strike by UPS workers was captured in the Express Mail model using a binary variable with a value of unity for 1997:4. The estimated own-price elasticity was -1.470 compared to -1.534 in R97-1.

2) Billing determinants for Priority Mail for GFY 1997 were made available. GFY 1997 Billing determinants for Express Mail were not available. The Priority Mail fixed-weight price index was computed using GFY 97 billing determinants. The estimated coefficients remained stable. The estimated own-price elasticity remained at -1.470.

3) As mentioned earlier, the large scale strike by UPS workers in August 1997 was at a national level and it caused a rippling effect through out the package industry. To account for the possible lingering effects of this strike, a dummy variable with four lags was used. The coefficients of the lags were estimated subject to Shiller Lags with the fourth lag being constrained to zero. The estimated own-price elasticity increased in absolute magnitude, to -1.529 which is closer to the R97-1 value of -1.534.

4) Billing determinants for GFY 1998 became available for Express Mail. The fixed-weight price indices were calculated using the new GFY 1998 billing determinants. However, the Priority Mail fixed-weight price index was still based on 1997 billing determinants as Priority Mail 1998 billing determinants were not available. The Express Mail model was estimated

with the new fixed-weight price index. The estimated long-run own-price elasticity remained stable at -1.543.

5) We modeled the moving seasonality using the X11-ARIMA program from Statistics Canada. The X11-ARIMA program was not year 2000 compliant. To avoid possible bugs we used an alternate method of modeling seasonality. We tried using the seasonal variables developed by RCF. These variables are the proportion of business days in particular intervals of the Postal calendar. RCF divided the Postal calendar into seventeen intervals. Seventeen seasonal variable were thus created. When we used these variables in the Express Mail model, many of the estimated coefficients had unexpected signs. In the case of Express Mail, the most pronounced seasonal effect is around Christmas. We modeled the seasonality using the seasonal dummies for Fall, Winter, Spring, and two additional seasonal variables to capture the influence of the moving Christmas seasonality. The first seasonal variable DEC1_23 is defined as the proportion of business days in a Postal quarter that fall in the period from December 1st to December 23rd inclusive. The value of Dec1_23 was 0.2698 in 1980:1 and 0.0 for the remaining Postal quarters of 1980. This means that the 17 business days from December 1 to an including December 23 represent 26.98 percent of the 63 business days in 1980:1. (Business days exclude Sundays, and seven holidays, count Saturdays as half days). The value of Dec1_23 remained at 0.0 for

Postal quarter two, three and four up to 1984. The value of Dec1_23 in Postal quarter 1985:1 was 0.2578 and in 1985:2 it was 0.0078. In 1999:1 the value of Dec1_23 declined to 0.0625 while in 1999PQ2 the value was 0.2266. By Postal fiscal year 2002 the value of Dec1_23 will be 0.0 in the first quarter and 0.266 in the second quarter. The second seasonal variable, DEC24_JAN1, measures the proportion of business days in a Postal quarter from December 24th to and inclusive January 1st. This is a period associated with relatively low volume. In 1980:1 the value of DEC24_JAN1 was 0.06349 and 0.02308 in the second postal quarter of 1980. The value was 0.0 for the remaining quarters of 1980. In 1984:1, the value of DEC24_JAN1 was 0.0 and in the second quarter the value was 0.0625. In 1999:2 DEC24_JAN1 took a value of 0.0859 and 0.0 for the remaining quarters of 1999. The Express Mail model was estimated using the three fixed seasonal dummies, Fall, Winter, Spring, and the two additional seasonal variables described above. The seasonal component of the residuals from X11 were excluded. The estimated coefficients of DEC1_23 and DEC24_JAN1 were statistically significant . The estimated own-price elasticity was -1.559.

6) Priority Mail billing determinants for GFY 1998 became available. The Priority Mail fixed-weight price indices were calculated using the new GFY 1998 billing determinants. The Express Mail model was estimated with all fixed-weight price indices based on GFY 1998 billing determinants. The

estimated long-run own-price elasticity remained stable at -1.561.

7) Monthly economic data are available before quarterly data. It was decided to use monthly economic data for all variables. Any historical or forecasts of exogenous variables from DRI, not available at monthly frequency were converted to monthly data using DRI's linear conversion method. The estimated long-run own-price elasticity increased slightly in absolute magnitude to -1.569 compared to -1.561 when some of the data were at quarterly frequency.

8) We received revised Priority Mail volume data for Postal quarters 1999:1 - 1999:4. These revised volume data were used to estimate the Priority Mail fixed-weight price index adjusted for the Priority Mail volume transferring to First-Class Mail. Express Mail model was estimated using the revised Priority Mail fixed-weight price index. The estimated long-run own-price elasticity increased slightly in absolute magnitude from -1.569 to -1.565. This is the final model used.

TECHNICAL APPENDIX E

Forecast Error Analysis

The following tables display the net trends and forecast errors for the Priority Mail and Express Mail models.

Priority Mail Net Trend Computation

PQtrs	Historical	Forecast
1995:1	198.433	191.968
1995:2	205.601	195.902
1995:3	206.875	200.839
1995:4	241.127	252.234
1996:1	212.199	213.570
1996:2	213.529	220.215
1996:3	222.589	223.632
1996:4	287.894	277.940
1997:1	239.130	231.454
1997:2	246.234	238.203
1997:3	244.627	244.688
1997:4	335.564	335.559
1998:1	274.592	274.938
1998:2	284.198	281.910
1998:3	275.764	277.447
1998:4	333.445	348.995
1999:1	288.325	289.157
1999:2	297.074	285.164
1999:3	276.050	273.359
1999:4	326.364	334.455
Sum 95Q1-99Q4	5209.615	5191.629

Volume 95:1 - 99:4	
Actual	5209.615
Forecast	5191.629
% Error	0.345%
Net Trend:	0.000692
Annual Net Trend Projection	
Factor 1995:1 to 1999:4	1.000692

PRIORITY MAIL FORECAST ERROR ANALYSIS

Forecast Errors From Forecasts Using Base Period 94Q1- 94Q4

Year	Fall	Winter	Spring	Summer
95	0.033124	0.048321	0.029614	-0.045034
96	-0.006443	-0.030830	-0.004676	0.035187
97	0.032626	0.033158	-0.000247	0.000015
98	-0.001257	0.008083	-0.006087	-0.045580
99	-0.002881	0.040917	0.009799	-0.024490

SPLY Differences of Forecast Errors:

Year	Fall	Winter	Spring	Summer
95	0.033124	0.048321	0.029614	-0.045034
96	-0.039566	-0.079150	-0.034289	0.080221
97	0.039069	0.063987	0.004429	-0.035172
98	-0.033883	-0.025074	-0.005840	-0.045594
99	-0.001623	0.032833	0.015886	0.021090

4-Quarter Averages of SPLY Differences:

Begin	End	
1995:1	1995:4	0.016506
1995:2	1996:1	-0.001666
1995:3	1996:2	-0.033534
1995:4	1996:3	-0.049510
1996:1	1996:4	-0.018196
1996:2	1997:1	0.001462
1996:3	1997:2	0.037247
1996:4	1997:3	0.046926
1997:1	1997:4	0.018078
1997:2	1998:1	-0.000160
1997:3	1998:2	-0.022425
1997:4	1998:3	-0.024993
1998:1	1998:4	-0.027598
1998:2	1999:1	-0.019533
1998:3	1999:2	-0.005056
1998:4	1999:3	0.000375
1999:1	1999:4	0.017047
SUM/17.0 =		-0.003825

Annual Net Trend Projection Factors:

1995:1 to 1999:4	1.000692
R2000-1 Forecast	1.000000

Express Mail Net Trend Computation

PQtrs	Historical	Forecast
1995:1	12.880	12.828
1995:2	13.610	13.494
1995:3	13.284	13.219
1995:4	16.962	16.643
1996:1	12.362	12.100
1996:2	13.516	13.092
1996:3	13.729	13.363
1996:4	17.516	17.301
1997:1	13.096	12.775
1997:2	14.377	13.957
1997:3	14.634	14.209
1997:4	20.807	20.424
1998:1	14.322	14.239
1998:2	15.567	15.427
1998:3	16.062	15.783
1998:4	20.177	19.918
1999:1	15.051	14.746
1999:2	16.090	16.176
1999:3	16.558	16.154
1999:4	20.668	20.662
Sum 95Q1-99Q4	311.268	306.509

Volume 95:1 - 99:4	
Actual	311.268
Forecast	306.509
% Error	1.529%
Net Trend:	0.003086
Annual Net Trend Projection	
Factor 1995:1 to 1999:4	1.003086

EXPRESS MAIL FORECAST ERROR ANALYSIS

Forecast Errors From Forecasts Using Base Period 94Q1- 94Q4

Year	Fall	Winter	Spring	Summer
95	0.004012	0.008598	0.004898	0.018937
96	0.021436	0.031925	0.027093	0.012357
97	0.024846	0.029640	0.029496	0.018573
98	0.005789	0.009080	0.017501	0.012969
99	0.020432	-0.005364	0.024744	0.000245

SPLY Differences of Forecast Errors:

Year	Fall	Winter	Spring	Summer
95	0.004012	0.008598	0.004898	0.018937
96	0.017424	0.023327	0.022196	-0.006580
97	0.003410	-0.002284	0.002403	0.006217
98	-0.019057	-0.020561	-0.011995	-0.005605
99	0.014643	-0.014444	0.007243	-0.012723

4-Quarter Averages of SPLY Differences:

Begin	End	
1995:1	1995:4	0.009111
1995:2	1996:1	0.012464
1995:3	1996:2	0.016146
1995:4	1996:3	0.020471
1996:1	1996:4	0.014092
1996:2	1997:1	0.010588
1996:3	1997:2	0.004185
1996:4	1997:3	-0.000763
1997:1	1997:4	0.002436
1997:2	1998:1	-0.003180
1997:3	1998:2	-0.007749
1997:4	1998:3	-0.011349
1998:1	1998:4	-0.014304
1998:2	1999:1	-0.005879
1998:3	1999:2	-0.004350
1998:4	1999:3	0.000459
1999:1	1999:4	-0.001320
SUM/17.0 =		0.002415

Annual Net Trend Projection Factors:

1995:1 to 1999:4	1.003086
R2000-1 Forecast	1.000000

Priority Mail Volume Forecast Errors

	Actual Volume	R97-1 forecast Table 1	Percent Error
PFY 1998	1167.999	1123.852	3.780%
	Actual Volume	R97-1 forecast using revised data	Percent Error
PFY 1998	1167.999	1168.078	-0.007%

Source:
Actual volume is the sum of the four postal quarters of 1998, LR-I-112, table C1, Page 104.
R97-1 forecasts Table 1 is from the Direct Testimony of Gerald L. Musgrave, USPS T-8, Table 1.
R97-1 forecasts using revised data are obtained from witness Musgrave (USPS T-8) LR H125, Before-Rates Forecasting spreadsheet, substituting the revised current data used in R2000.
Note:
Both forecasts use the same model coefficients as in R97-1. The forecast in the first line uses the DRI forecasts of the explanatory variables. The forecast in the second line uses the actual values.

Express Mail Volume Forecast Errors

	Actual Volume	R97-1 forecast Table 1	Percent Error
PFY 1998	66.128	64.228	2.873%

	Actual Volume	R97-1 forecast using revised data	Percent Error
PFY 1998	66.128	64.625	2.274%

Source:
Actual volume is the sum of the four postal quarters of 1998, LR-I-112, table C1, page 104.
R97-1 forecasts Table 1 is from the Direct Testimony of Gerald L. Musgrave, USPS T-8, Table 1.
R97-1 forecasts using revised data are obtained from witness Musgrave (USPS T-8) LR H125, Before-Rates Forecasting spreadsheet, substituting the revised current data used in R2000.
Note:
Both forecasts use the same model coefficients as in R97-1. The forecast in the first line uses the DRI forecasts of the explanatory variables. The forecast in the second line uses the actual values.

SUPPLEMENTAL APPENDIX

Introduction

In reviewing the documentation, I discovered an error in the computation of the after-rates fixed-weight price index for Priority Mail. The change in the index is from 4.435790 to 4.435274 and implies that, based on the same proposed rates, the actual size of the after-rates price increase is slightly smaller at 15.05% rather than 15.06%, as in my testimony. This price change would cause the test-year Priority Mail volume forecast to be 1,226.246 million pieces rather than 1,226.160 million pieces, as in my testimony. Priority Mail price is also in the Express Mail model and the changed test-year forecast volume would be 72.298 million pieces rather than the 72.301 million pieces, as in my testimony.

Changes in Testimony

No changes to the before-rates forecasts are needed. The correction only involved the after-rates volumes. The error was in Library Reference I-111 in the after-rates volumes for the billing determinants for the two pound and less pieces. The changes are in the Section B-I after-rates fixed-weight price index (FWPI), Sections B-I-i, iii and iv. The proposed after-rates, in Section B-I-ii are not changed. The changes result in the FWPI value of 4.435274 as seen in B-I-iv. Those changes are contained in Library Reference I-129.

Because the changed after-rates FWPI is smaller than in the testimony, the computed price increase is smaller, even though the proposed rates are the same and have not changed. The after-rates increase would be 15.05% rather than 15.06%. The after-rates test-year forecast for Priority Mail would be higher at 1,226.246 million pieces rather than 1,226.160 million pieces, as in the testimony. Since the Priority Mail FWPI is in the Express Mail model, the after-rates forecast for Express Mail would also change. The supplemental test-year forecast would be 72.298 million pieces versus 72.301 million pieces in my testimony.

The reduction in the Priority Mail after-rates volume forecasts would change the estimate of the after-rates volume transferring to First-Class Mail due to the 11-13 ounce break-point change in R97-1. The supplemental estimated transfer volume for the test-year would be 157.020 million pieces versus 157.018 million pieces. The forecasts were in Library Reference I-114 and the changes to the transfer volume forecasts relating to this supplemental appendix are in Library Reference I-129.

Electronic copies of these changes and explanations of changes to the spreadsheets are also in Library Reference I-129.

Summary Table

A supplemental version of Table 1 is displayed on the following page. It shows what the Priority Mail and Express Mail volume forecasts for the test year and for other periods would be if the information contained in this Appendix had been appropriately included within the forecasting model. Changes to the forecasts are displayed in bold face type.

TABLE 1
VOLUME PROJECTIONS
(MILLION PIECES)

BASE YEAR: Postal Quarter 99:1 - 99:4

Priority Mail	1187.813
Express Mail	68.366

Before-Rates

Postal Qtr	Priority	Express	Postal Year	Priority	Express
2000:1	271.724	15.028	2000	1205.872	69.477
2000:2	286.588	16.609	2001	1324.229	71.491
2000:3	287.397	16.584			
2000:4	360.163	21.256			
2001:1	293.441	15.250			
2001:2	319.182	17.173			
2001:3	316.372	17.073	GFY	Priority	Express
2001:4	395.234	21.995	2000	1217.641	69.876
2002:1	320.137	15.832	2001	1331.105	71.641

After-Rates

Postal Qtr	Priority	Express	Postal Year	Priority	Express
2000:1	271.724	15.028	2000	1205.872	69.477
2000:2	286.588	16.609	2001	**1228.116**	**72.077**
2000:3	287.397	16.584			
2000:4	360.163	21.256			
2001:1	**287.514**	**15.274**			
2001:2	**300.737**	**17.222**			
2001:3	**286.321**	**17.232**	GFY	Priority	Express
2001:4	**353.544**	**22.349**	2000	1217.641	69.876
2002:1	**286.180**	**16.109**	2001	**1226.246**	**72.298**