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THE IMPACT OF USING WORKSHARING TO LIBERALIZE A POSTAL MARKET

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Econometric Appendix
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Introduction

The United States letter monopoly is among the least liberal in the world because it is not subject to price or weight limitations.[1,2] The U.S., however, allows worksharing, which has grown steadily and substantially over time. As a result, much of the value chain is now in the hands of mailers and third-party consolidators, and, due to worksharing, the U.S. has the most liberalized postal market in the industrialized world. Because even total liberalization of the monopoly may not be effective in creating postal competition (e.g., Sweden and New Zealand), worksharing may be a more effective way to introduce competition into a postal market.[3]

During the latter part of the 1960's the Readers Digest Association attempted to persuade the Universal Postal Union (UPU) and postal administrators in the U.S. and some other countries where it did business to offer a discount for mailer presortation.[4] They all refused. A short time later the Postal Reorganization Act of 1970 required the Postal Service to submit to the newly created Postal Rate Commission a comprehensive classification schedule for its approval.[5] Finding that it no longer had unilateral control over classification and in an attempt to secure support from mailers for the then current classification schedule, the Postal Service proposed a scant half-cent discount for presorting in 1973.[6,7] During the course of a lengthy proceeding the Postal Service revised its proposed discount to a full cent based on a new study. In 1976 the Commission approved a unanimous settlement by the parties to the proceeding that included a one-cent discount for presorting First-Class mail.

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[1] There is an exception for urgent mail that requires overnight delivery and has a price twice the applicable First-Class postage with a minimum of $3.00.
[2] The so called "mailbox law" prohibits delivery to a mailbox by anyone but the Postal Service.
[3] *See* "Universal Service Without a Monopoly", Current Directions in Postal Reform, Ed. Michael A. Crew and Paul R. Kleindorfer (Boston: Kluwer Academic Publishers, 2000), Robert H. Cohen et al.
[4] A Presidential Commission also mentioned the possibility of presort discounts. *See* The Report of the Presidents Commission on Postal Organization, Annex, Vol. II, p. 7-17, June 1968.
[5] A classification schedule is a list of all the products the Postal Service is authorized to offer and it includes general terms and conditions for their use.
[6] Before Postal Reorganization in 1970, Congress had authority over classification, but in practice it deferred to the Postal Service on these matters.
[7] Docket MC 73-1. The Postal Service also proposed several other minor changes to the existing schedule in that docket.

Many at the Postal Service criticized this concession to Readers Digest *et al.*, as a windfall to those large First-Class mailers who already were presorting some mail without a discount. These mailers maintained computerized mailing lists that made it relatively easy to produce mail in ZIP code sequence to achieve better service.

When total mail volume declined for the first time in three decades (owing to the oil price induced recession of 1974/75), the Postal Service launched a study to examine ways to promote volume growth through the use of classification.[8] That study (completed before the First-Class presort discount was approved by the Rate Commission) saw presort for all classes of mail as a means to lower the real cost of mail and thus promote volume. The study also saw presorting as a way to deaverage rates in all classes of mail and allow rates to track costs and so promote economic efficiency in the nation. It reasoned that large volume mailers had the lowest cost mail, were most capable of presorting and were more price elastic than average. It observed that large volume mailers would have the greatest motivation to seek alternatives to the Postal Service and by lowering rates for these mailers, presort discounts would help prevent cream-skimming.

Headquarter staff objections to the proposed reclassification program cited increased rate complexity and difficulties for revenue protection. Questions also were raised about the program's consonance with Congressional intent because Congress had approved the old system with average rates applied to mail regardless of presort level.[9]

In the end, the Service embraced worksharing discounts in part because it felt it would be a beneficiary, in part because it made good economic sense, and in part because presort discounts were seen as a means to palliate rate increases.[10] During the latter part of the seventies and early eighties, the U.S. was experiencing high

[8] Postal Service staff study, "The Necessity for Change", Appendix 3, Restructuring the Postal Classification Structure on Economic Principles, reprinted by House Committee On Post Office and Civil Service Comm. Print No. 26, 94th Cong., 2nd Sess. (1976).
[9] At that time Periodicals and advertising mail had to be presorted by the mailer in ZIP code sequence, but rates were not based on the degree of presort.
[10] The Postal Service proposed presort discounts for Periodicals in PRC Docket R77-1.

inflation and rate increases were sizable. Worksharing was the one thing that mailers, the Postal Service, and the Rate Commission could all agree to.

Starting with the modest proposal of a half-cent discount for First-Class presort in 1973, the worksharing program blossomed to include presort and barcode discounts for virtually every class of mail and dropshipping for most. One of the most surprising and unanticipated results of presort discounts in First-Class was the emergence of one or more third-party consolidators (called presort service bureaus) in almost every sizable city in the U.S. They produce about one-third of all presorted First-Class mail. They pick up mail on a scheduled basis from mailers who either don't want to be bothered with presorting themselves or who have insufficient volume for presorting. Service bureaus barcode and sort mail and frequently bring it directly to the airport mail facility for outgoing dispatch (bypassing the originating office).

Description of Worksharing Activities

Worksharing is essentially an unbundling of the postal value chain that allows mailers to select the activities they wish to purchase from the Postal Service with the proviso that the Postal Service always performs the delivery function. The selection of activities purchased depends in large part on (i) the volume and ZIP code density of the mailing (ii) the distance to the delivery point from the place of manufacture, and (iii) mailer cost.

Presortation

To receive a discount for presorting, a mailer or consolidator must present its mail in bulk.[11] The mail must be faced, not require cancellation, and letters and flats must be presented in containers or in packages that are on pallets or in sacks. The Postal Service generally offers four levels of discounts; 3-digit (ZIP code sortation), 5-digit, carrier route (including sorting to the carrier's walk sequence) and basic or

[11] A bulk mailing implies a minimum quantity, which differs from class to class. The bulk category of First-Class requires a minimum of 500 pieces and advertising mail requires a minimum of 200 pieces. In addition, the mailing must meet the makeup requirements for that class as stated in the Domestic Classification Schedule of the Rate Commission and in the Domestic Mail Manual of the Postal Service.

residual.[12] Periodicals and advertising mail have two additional levels of presort; high density and saturation. High density generally requires a minimum of 125 pieces per carrier route; saturation generally requires at least three quarters of the addresses on a carrier route receive the mailing.

Pre-Barcoding

Barcoded mail is sometimes referred to by the Postal Service as automation mail. Most letters and flats processed by the Postal Service are barcoded by the mailer or presort service bureaus. Automation discounts for First-Class, Periodicals and advertising mail require mail to be encoded with the street address and city, state, and ZIP code information.[13] To qualify for automation discounts, the addresses must be extremely accurate and contain all required information (e.g. apartment numbers and street directionals). Mailing lists used for automation mail must be checked against a USPS address database to verify that the addressee still resides at the address on the list.[14,15] Barcode discounts for parcels require only the ZIP code to be encoded.

Barcodes on letters are used by the Postal Service to sort them to the walk sequence of carriers. This is called Delivery Point Sequencing. The Service is now involved in a program to walk sequence flats. The cost avoidance for presorted letter mail is based partly on the delivery sequence operation.

Dropshipping

Parcels and Periodicals have zone rates (based on transportation costs which reflect distance). Mailers have always been able to transport zone rated mail to a post

[12] As an efficiency measure, minimum volumes are required for each level of presort; volumes not meeting the minimum for 3-digit are submitted as basic.
[13] The term advertising mail, as used here, is all mail that the Postal Service now calls the Standard subclass and was formerly called Standard A or third-class mail.
[14] Fifteen percent of the U.S. population moves annually. *See* Table No. 28, Current Population Reports, U.S. Census Bureau, 1999. Thus, undeliverable as addressed mail is a considerable problem for the U.S. Postal Service.
[15] Third-party consolidators can correct out-of-date addresses in a mailing by using an optical character reader and a software program called FASTforward that checks names and addresses against a national database.

office closer to the destination to save on postal transportation charges. This is frequently called zone skipping.

The term "dropshipping" will be used here to mean mailer transport to enter mail more deeply in the sorting network, thereby bypassing handling operations. Zone rate differentials traditionally reflect only transportation costs, but drop shipment discounts reflect both handling and transportation savings.[16] The ultimate dropshipment discount is for mail entered at the carrier delivery facility (destination delivery unit - DDU).[17] Mailers of bulk categories (except for First-Class) make extensive use of dropshipping which not only saves costs but it also results in improved service.[18]

No dropship discounts are offered for First-Class mail (about half of total U.S. mail). There has been little demand for this discount by mailers of First-Class, in part, because the potential savings over and above presortation and barcoding is small.[19] Moreover, First-Class mailings are generally not as dense as mailings in the Periodicals or advertising classes. Without consolidation, it would be difficult to obtain sufficient volumes to make dropshipping First-Class worthwhile. Moreover, consolidating mail for transportation purposes involves some delay and First-Class mail is usually time sensitive.[20] Finally, a First-Class dropship discount even limited to bulk mailings would involve a great amount of deaveraging.

[16] Advertising mail makes the most extensive use of dropshipping. On average 21 percent of the advertising mail dropship cost avoidance is from handling and 79 percent is from transportation.
[17] ADVO Corp., the world's largest mailer, enters about 80 million pieces weekly into about 4000 delivery units all over the U.S.
[18] The deeper into the sorting network mail is dropshipped, the faster it is delivered and the narrower is the window for its delivery.
[19] First-Class mail is usually light and not costly to transport, even by air. Transportation savings would average no more than a cent. Local entry would avoid some handling costs as compared to entry at a distant city.
[20] Sending First-Class mail to the destination city by electronic means and printing and inserting it into the mail at the destination post office might become common if a large enough discount were installed. This could provide a reliable national overnight service in contrast to the current two to three day service standard for non-local mail. Because worksharing discounts promote volume growth (as will be seen below), it may be beneficial to the Postal Service to offer a dropship discount for First-Class.

The hierarchy of the U.S. Postal Service network is:

Bulk Mail Centers (BMC)[a]	21
Sectional Center Facilities (SCF) (3-Digit Areas)	900
Delivery Destination Units (DDU) (5-Digit Areas)[b]	24,000
Carrier Routes	236,000

a. Preferential mail (First-Class and Periodicals) are not handled at BMC's.
b. Many DDU facilities serve more than one 5-digit ZIP code.

The level to which mail is dropshipped depends on volume, weight, cube and distance from manufacturing plant.

Discounts for Worksharing

Table 1 presents some current rates for nonworkshared and workshared mail. It can be seen that the discounts range from as low as six percent to over 60 percent. Worksharing increases the complexity of the bulk mail rate structure. Discounts depend on shape (letter, flat, other), presort level, dropshipment point and the presence or absence of a mailer applied barcode. The commercial advertising mail rate structure alone has over 60 rate categories. Worksharing does not affect the complexity of the rate structure for single piece categories.

Fairness is an important element of the U.S. postal statue. All discounts are based on cost savings. The Postal Service has no contract rates for domestic mail and all mailers have access to the same rate schedule.

Table 1

Examples of Worksharing Discounts [a]

(Cents)

Rate Category	Rate	Discount [b]	Discount Percentage [b]
First-Class			
Single-Piece	34.0	-	
Nonbarcoded Presort	32.0	2.0	6
Barcoded 3-Digit Presort	26.7	7.3	21
Single-Piece Postcard	20.0	-	
Barcoded 5-Digit Presort Postcard	15.1	4.9	25
Periodicals			
Basic Presort - Nonbarcoded (zone 4, 8 oz., 50% advertising)	40.65	-	
Basic Presort - Barcoded (zone 4, 8 oz., 50% advertising)	36.55	4.10	10
5-Digit Presort - Nonbarcoded (zone 4, 8 oz., 50% advertising)	29.55	-	
5-Digit Presort - Barcoded (zone 4, 8 oz., 50% advertising)	27.15	2.40	8
Carrier Route Presort - zone 4 (8 oz., 50% advertising)	21.750	-	
Carrier Route Presort - SCF (8 oz., 50% advertising)	18.575	3.175	15
Standard Mail (Commercial) [c]			
Basic Letter - Nonbarcoded	25.0	-	
5-Digit Letter - Barcoded	17.4	7.6	30
5-Digit Letter - Barcoded entered at DBMC	15.5	9.5	38
Basic Flat - Nonbarcoded	31.9	-	
ECR Saturation Flat	14.7	17.2	54
ECR Saturation Flat entered at DDU	11.8	20.1	63
Package Services			
Parcel Post Inter-BMC 3lb., zone 3 (no worksharing)	413	-	
Parcel Post Inter-BMC 3lb., zone 3 (barcoded and presorted to BMC)	387	26	6
Bound Printed Matter single-piece, 6 lb. zone 1&2	220	-	
Bound Printed Matter 6 lb., DSCF entry	101	119	54

[a] Effective January 7, 2001

[b] Discount are from the benchmark; Discount percentage equals 100 x (Benchmark Rate - Discount Rate)/(Benchmark Rate)

[c] All examples are pieces weighting less than 3.3 ounces

Worksharing Volumes and Cost Savings

The 1999 presorted and barcoded volumes and associated cost savings to the Postal Service are displayed in Table 2. Dropship volumes and associated cost savings are displayed in Table 3. In 1999 the total cost savings from all worksharing activities was $15.3 billion or nearly one quarter of total USPS costs of $62.2 billion.

If the Postal Service had no worksharing discounts and instead performed all work on its total volume in 1999, its costs would have been $77.5 billion. We do not know the cost to the mailers for worksharing. In many cases the cost of presorting is quite low because much of the work is the computerized sorting of mailing lists.[21] It is reasonable to conclude, however, that the net savings to mailers and to the U.S. economy are quite substantial.

Table 2 shows that almost half of First-Class letters and cards are presorted. Given the rates of growth of workshared and single-piece First-Class mail, the volume of the former will exceed the volume of the latter in one to two years. Carrier route presort amounts to only one percent of First-Class mail. This is because (i) the amount of First-Class mail that can be sorted to the carrier route level by First-Class mailers and consolidators is inherently small, and (ii) the Postal Service provides these discounts only in the areas where they have no delivery point sequence machinery in place.[22]

The *basic* categories of Periodicals and advertising mail receive discounts for barcoding only. *Basic* is a small component of each (8 percent and 10 percent respectively). Advertising mail accounts for nearly sixty percent of the total cost savings for all presorted and barcoded mail.

Single piece parcels are sent largely by households and small businesses. Almost all bulk parcel shippers presort and barcode.

[21] In the case of barcoding there are costs to prepare mailing lists in proper format, insuring properly coded addresses, and maintaining current addresses. In the case of dropshipping, the mailer has additional transportation costs but presumably little additional handling cost.

[22] Few mailers besides utilities and government agencies have enough First-Class mail to presort to carrier route.

Table 2

Presorted and Barcoded Mail[a]

	Volume (billions)	Percent of Total Mail	Cost Savings to the USPS ($ millions)
First-Class			
Single-Piece	57	28	N/A
Non-barcoded Presort	5	2	43
Barcoded Presort			
Basic	5	3	409
3-Digit	22	11	1,918
5-Digit	12	6	1,248
Carrier Route	1	1	138
Total First-Class	102	51	3,755
Publications			
Basic[b]	1		8
3-Digit	2	1	125
5-Digit	3	2	380
Carrier Route	5	2	923
Total Publications	10	5	1,436
Advertising Mail			
Basic[b]	9	4	272
3/5-Digit	41	20	2,679
Carrier Route	36	18	4,613
Total Advertising Mail	86	42	7,564
Package Services			
Single-Piece			
Barcoded Presort	1		136
Total Package Services	1	1	136
Other Mail	3	1	
Total All Mail	202	100	12,891

a: FY 1999 volumes; cost savings from PRC Docket No. R2000-1.
b: Savings from barcode only.

In Table 3 no dropshipped volume is shown for First-Class because no such discount is available. An unknown amount of First-Class is dropshipped for service reasons. For all classes of mail it is difficult to assemble the density to make it economically feasible to dropship at the DDU level.

Table 3

Dropshipped Mail[a]

	Volume (billions)	Percent of Total Mail	Cost Savings to the USPS ($ millions)
First-Class Mail			
Nondropshipped	**102**	**51**	
Total First-Class Mail	**102**	**51**	
Publications			
Nondropshipped	**7**	**3**	
DSCF	**3**	**2**	**64**
DDU	**0**	**0**	**7**
Total Publications	**10**	**5**	**71**
Advertising Mail			
Nondropshipped	**32**	**16**	
BMC	**19**	**10**	**509**
DSCF	**27**	**13**	**895**
DDU	**8**	**4**	**329**
Total Advertising Mail	**86**	**42**	**1733**
Package Services			
Nondropshipped	**1**	**0**	**0**
BMC	**0**	**0**	**475**
DSCF	**0**	**0**	**44**
DDU	**0**	**0**	**93**
Total Package Services	**1**	**1**	**612**
Other Mail	**3**	**1**	
Total All Mail	**202**	**100**	**2416**

a: FY 1999 volumes; cost savings from PRC Docket No. R2000-1.

The rate structure for Periodicals includes a zoned rate for the advertising portion and an unzoned rate for the editorial portion. Historically this was implemented by Congress to encourage the widespread dissemination of editorial content. Thus dropship discounts for Periodicals are usually insufficient to compensate mailers for the cost of dropshipping. Most dropshipping that does occur in the Periodicals class is to improve speed of delivery. The amount of dropshipping would increase substantially if the rate structure were revised to reflect the marginal cost of distance (i.e., recognize the marginal transportation cost of both the advertising and editorial portion of Periodicals).

The Impact of Worksharing on Employment

If the Postal Service had to perform all the worksharing functions performed by the private sector, mail processing labor costs would have increased from $14.7 to $22.7 billion in 1999. This translates into a workforce increase of 187 thousand, taking the Postal Service from 907 thousand to 1.1 million employee work years (a 22 percent increase). The U.S. Postal Service is one of the largest civilian bureaucracies in the world. By reducing its size, worksharing has likely made it more efficient and less difficult to manage.

The Impact of Worksharing Discounts on Volume

Advertising Mail

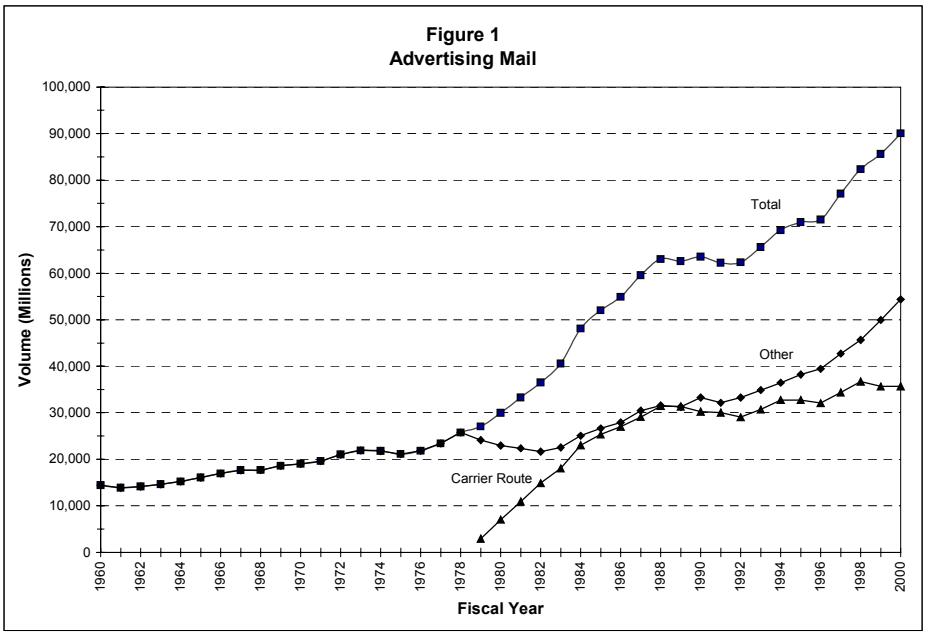
The most important impact of worksharing discounts on volume has been in advertising mail. Since the introduction of discounts in this class of mail in 1978, advertising mail volume has grown 240 percent. Today, advertising mail accounts for 43 percent of total volume, 23 percent of revenue and 21 percent of total contribution to institutional costs. Direct mail has grown to be an important factor in the United States advertising industry, commanding a market share of about 20 percent. Households now receive more advertising mail than First-Class.

Figure 1 displays the volume history of advertising mail from 1960 to 2000. It can be seen that after the introduction of the first worksharing discount (carrier route presort) the rate of growth increased substantially. The average annual growth rate for advertising mail before the introduction of the carrier route discount in 1978 was 3.5. Between 1978 and 2000 the growth rate for advertising mail increased to 5.9 percent, a nearly 70 percent increase. Of course, other important changes were taking place which influenced advertising mail volume. Women were entering the workforce in increasing numbers and presumably increased their use of mail order catalogues. Computer prices were dropping rapidly and software was being developed to make it cheaper and easier to use demographic and other data relevant to targeting mail.

No mail was being presorted to the carrier route level prior to 1978 because the information that mapped addresses to carrier routes was not available in a form suitable for use by mailers. Carrier route mail grew rapidly through 1988 and then its growth

slowed dramatically exhibiting the growth characteristics of a mature product. While total advertising mail also leveled off in 1988, rapid growth resumed after 1992. Growth for both categories was hurt by successive 25 percent rate increases in 1989 and 1991. In addition, the recession of 1991 had a large impact on total U.S. advertising expenditures, which actually dropped for the first time in many years. In 1995 a 13 percent rate increase again affected growth.

Advertising mail has had more worksharing innovations than any other class of mail. No doubt these have contributed to its stellar growth rate. Appendix 1 is a listing of advertising mail discounts by year of introduction.



Worksharing discounts proved to be a catalyst for increasing volumes. After the first discounts were introduced in 1977, software was quickly developed to assist mailers to implement the new makeup rules. Vendors approached large mailers in an attempt to persuade them to use the new discounts so they would have a market for their software. Mailers were persuaded by simple return on investment analyses.

With ZIP codes becoming increasingly important, software vendors began to map census data onto 3-digit, 5-digit ZIP codes, and carrier routes.[23] Vendors were

[23] In theory, census data could be used without worksharing, but it was used very little prior to the introduction of worksharing discounts.

then in a position to show advertising mailers how to target mailings and greatly improve response rates. The discounts only made targeted mailings even more enticing.

The software industry is now a vital part of the worksharing industry. It is used for mailing list hygiene, demographic targeting, printer bindery instructions for mail preparation, logistics analysis (for dropshipping), etc. The industry has become a major force in the expansion of worksharing and promoting volume. This was unanticipated by the Postal Service when worksharing was introduced.

First-Class

Figure 2 displays the volume of First-Class (including cards) from 1960 through 2000. Growth increased monotonically from 1960 through 1971 but was flat from 1971 through 1976. This latter period included large percentage rate increases in 1971 (33 percent), 1974 (25 percent) and 1975 (33 percent), and the recession of 1975/76. First-Class volume growth resumed following introduction of the presort discount in 1977, in spite of rate increases in 1978 (15 percent) and again in 1981 (33 percent).

Figure 2
First-Class Mail

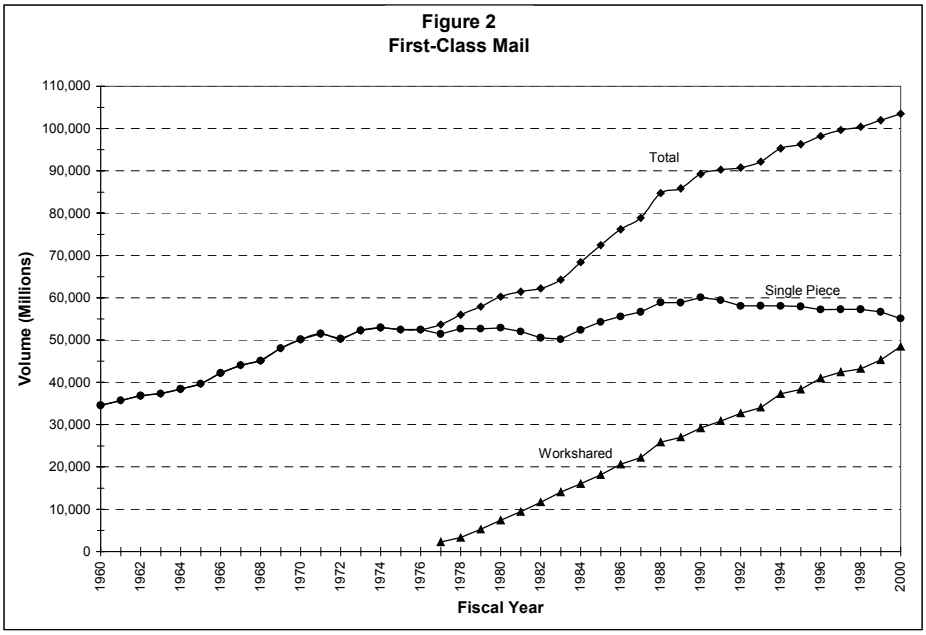


Table 4 provides the average annual growth rates for the periods in question. It can be seen that the growth rate for total First Class accelerated from the 1960 - 1971 rate to the higher 1977 – 1988 rate after the introduction of worksharing. Remarkably, with the introduction of presort, single-piece growth virtually stopped. Initially, this was due to large volume mailers converting from single-piece to presort. By the end of 1988 most of this conversion had been completed. In spite of population growth, single-piece mail declined during the decade of the 90's at an average annual rate of -0.6 percent. The decline is even more pronounced when measured on a per capita basis (-1.5 percent) or on a per household basis (-1.7 percent). The decline is probably due to the impact of electronic diversion (internet, fax and electronic data interchange) from businesses and households.[24] In contrast, presort mail has grown at a 5.4 percent rate since 1988. It is primarily sent by large volume mailers to households.

Table 4

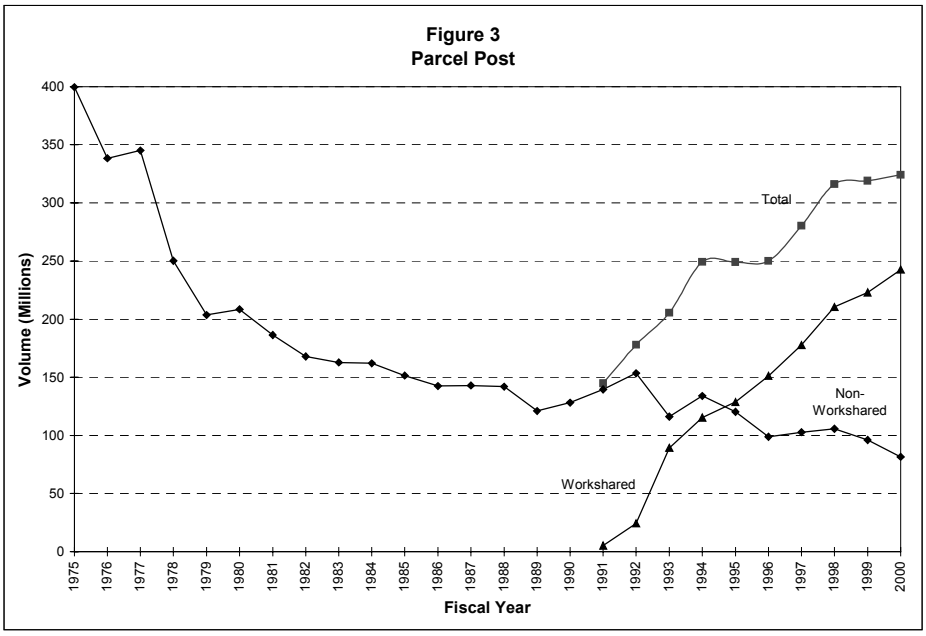
First-Class Mail
Average Annual Growth Rates
(Percent)

	Single-Piece	Total
1960 – 1971	3.6	3.6
1977 – 1988	1.0	4.1
1988 – 2000	-0.6	1.7

Parcel Post

Perhaps the most striking impact of worksharing discounts has been on parcel post (general merchandise ground service parcels). Its volume began an almost monotonic decline in the early 1950's as it lost market share to United Parcel Service.[25] Figure 3 shows the decline continuing from 1975 until finally leveling off and then beginning a sharp increase with the introduction of the first worksharing discount.[26] Volume grew by two and a half times from then to 2000.

[24] Households account for about 27 percent of single-piece.
[25] Parcel post has also lost market share to the Postal Service's premium parcel product, Priority Mail.
[26] Destination BMC dropship was introduced in 1991. SCF & DDU dropship were introduced in 1996.



A third-party consolidator emerged when that discount was initiated in 1991. Currently two large and several small consolidators specialize in parcel post. They primarily serve the catalog industry. By dropshipping at the destination BMC or deeper into the network, the shipper saves not only postage but also cuts the time to delivery and narrows the window when delivery will occur. These are important considerations for catalogue shippers. With dropship parcel post the Postal Service has basically gone into partnership with consolidators. The latter provide most if not all of the line haul, while the Postal Service provides the remaining transportation, sorting and delivery. Using worksharing, the Postal Service has developed a much more competitive product.

Econometric Confirmation That Discounts Generate New Mail

To test the hypothesis, that worksharing discounts have caused volume growth, econometric models that estimate the amount of new mail generated by the introduction of worksharing discounts for First-Class and Standard Mail are presented in Appendix 2. The model equations use volumes per household as the dependent variable and conventional economic determinants of demand, deflated postal rates and real gross domestic product per household plus a sparse set of exponential dummy

variables to capture the effects of service innovations and other one time changes in postal regulations and rate structures.

The models fit volume per household time series data with great precision. For most categories of presorted and nonpresorted mail the actual and the predicted volumes per household correspond almost exactly. Even First-Class cards, a small subclass that cannot be fit very well with conventional demand equations, yields a good fit. The R-squared statistics range from 0.979 to 0.998 thus confirming the visual impressions of a good fit.

The logarithmic dummies used in the models treat shifts in mail volumes over the years following the introduction of a worksharing discount in a way designed to reflect the hypothesis that the proportion of the shift that occurs follows an exponential path over time towards a limiting value. The estimated growth rates are statistically significant and range from 20 percent for Standard nonprofit to 44 percent for First-Class cards to 33 percent for First-Class letters. In addition, the models incorporate a parameter to explain the volumes of mail that were shifted from nonworksharing to worksharing categories following the creation of 5-digit and carrier-route categories of workshared mail. Estimates of the percentage of mail migrating to workshared categories during the exponential growth period are 40.14% for First-Class letters, 100% for First-Class cards, and 25.99% for Standard regular. The importance of specific service innovations and other structural changes in postal rules and rates is strongly confirmed for every subclass examined with the model by the estimates of the coefficients for the exponential dummy variables. These estimates, along with standard errors and t-values, are shown in the tables in Appendix 2. The coefficients are least squares estimates of the migration percentages and growth rates. Consequently, the standard deviations and t-values do not account for the uncertainty surrounding the estimates of these values. Nevertheless, the t-values are so high in most cases that any values of migration percentage and growth rate chosen within a fairly wide range of the values used will not have much effect on the finding that sizable amounts of new mail has been generated by the introduction of worksharing discounts.

Estimating Cost Savings from Worksharing Discounts

Estimating cost avoidances for worksharing has been the subject of considerable analysis and litigation before the Postal Rate Commission. From the outset the Postal Service has used engineering models to estimate the savings. These estimates are now adjusted to match independent estimates provided by the statistical systems used by the Postal Service to estimate attributable costs for the classes of mail.[27]

Engineering Models or Statistical Data Systems

The first engineering analysis done for the 1973 initial classification filing indicated a one-half cent cost avoidance and was later revised to one-cent. The statistical cost systems of the Postal Service, however, measured a 5-cent cost difference in 1977, the first year the discount was in effect. Much thought has been given to the discrepancy. Some observers believed that the statistical systems were capturing cost differences between the two mail streams that reflected factors not related to presort. Other observers felt that the engineering models simply failed to capture all the cost savings resulting from presortation.

The Postal Service has addressed the issue by building increasingly complex engineering models of the different worksharing categories and nonworksharing benchmarks. The models use machine accept and reject rates for the different categories, mail flow densities, entry profiles, manual carrier sequence percent, two pass and three pass delivery point sequence percentages, containerization, interfacility flow patterns, physical characteristics of mail pieces, etc. It turns out that the sum of the modeled mail processing costs of all the workshared categories in a class of mail usually do not sum to the mail processing cost for that class identified by the IOCS.

[27] The most important of these systems is the in-office cost system (IOCS). The IOCS measures costs for the classes of mail for all the in-office functions of clerks, mailhandlers and city delivery letter carriers. The IOCS uses a probability sample at an instant of time to estimate proportions of employee time spent on various activities, including time spent processing each category of mail. The system uses a stratified random sample of offices and a random sample of employees. An employee is observed at a random moment in time and a trained data collector records his or her activity (including the category of mail, if any, he or she is working on). In 1999, over 835,711 tallies were taken. The distribution of tallies represents a distribution of employee time to the various categories of mail. This allows the allocation of attributable cost based on employee time.

The modeled costs are then scaled up (or down) to the IOCS costs so that the worksharing category cost represents the proper proportion of the IOCS cost for that class. This ensures that the modeled cost is tied to the cost from the statistical systems.

Recently, the Postal Service refined this process in an attempt to isolate further the cost savings from worksharing activities. In determining the factors used to scale the model costs to the IOCS, cost pools that reflect activities not affected by worksharing are excluded from the analysis. These non-worksharing related costs are not considered when calculating the savings between categories of mail.

The final step in the process is to determine the cost avoidances. This is done by selecting a nonworksharing benchmark. This benchmark is then compared to the category of mail with the lowest degree of presort to determine the cost avoidance for that category. The category of mail with the next lowest degree of presort is then compared with the category with the lowest degree of presort to determine the cost avoidance for it, and so on.

Benchmarks

Benchmark selection affects the size of the cost avoidance and hence the discount. This makes selection of the benchmark and development of the benchmark's unit cost extremely important. It is possible to misstate worksharing cost savings through the benchmark selection process. A benchmark with a cost that is too high will overstate worksharing cost savings, while a benchmark with a cost that is too low will understate cost savings. The benchmark currently used in First-Class is bulk metered mail (unpresorted and not barcoded).

Benchmark selection has also been the subject of considerable debate in Commission hearings. In the past, this question has been resolved on an *ad hoc* basis in the context of the evidence in the record. Although no overall conceptual theory underlies the process of benchmark selection for all worksharing programs, the goal is to determine the cost savings to the Postal Service if mailers participate in the worksharing program.

In theory, an "exact piece" analysis is appropriate for establishing worksharing cost savings. Under this approach, the savings should reflect the cost savings between a workshared mail piece and the same mail piece assuming no worksharing.

In practice, for the reasons noted above, cost savings to the Postal Service can vary from one mailer to another. If the benchmark is selected on a basis that assumes current worksharing participants revert to a nonworksharing status, the benchmark cost will likely differ from a benchmark that focuses on potential converts to the program. Current participants are likely to be lower cost mailers, since it was easier for these mailers to conform to the make-up requirements associated with the worksharing programs. The maturity of the worksharing program is a factor, since longevity may determine which mailers have converted.

The benchmark problem is not limited to the issue of marginal vs. average cost of participating mailers. Other possibilities exist, such as subsets of participating mailers or some overall figure representing both current and potential participants. The question of what cost comparison to make for worksharing purposes can be difficult to resolve.

Efficient Component Pricing (ECP)

Several possible approaches exist for establishing worksharing discounts including Ramsey prices and ECP.[28] The latter requires only a subset of the information required for Ramsey prices (i.e., marginal costs) but Ramsey requires a great deal additional information on elasticities and especially cross-elasticities.[29] Consequently, estimates of the ECP prices can be developed more easily and with greater confidence than Ramsey prices.

The Rate Commission has used ECP for setting discounts. This means that

[28] Of course, it is also possible to set discounts without regard to welfare or efficiency considerations. Such an approach might set them just large enough to encourage mailers to workshare but not as high as avoided cost.

[29] *See* "Postal Pricing: Ramsey Prices and Efficient Component Prices," Diffusion of New Regulatory Approaches in the Postal Sector, Ed. Stumpf and Plum, WIK, 1997, Robert W. Mitchell et al.

discounts are generally set equal to the cost savings and each worksharing category in a class makes the same unit (per piece) overhead contribution.[30] ECP has the advantage of *Pareto* optimality because no rate will have to increase when a new worksharing discount is established.[31] This makes new worksharing discounts acceptable to all mailers in a class, even those who will not make use of the discount. In a litigated rate setting system as in the U.S., this is a considerable virtue.

ECP also has the property that the Postal Service is indifferent as to who does the work (itself or the mailer). Either way the Postal Service collects the same unit contribution to institutional costs. Finally, ECP will result in productive efficiency, with the lowest cost provider doing the work and this is beneficial to the economy.

[30] New discounts are frequently set at less than avoided cost because of uncertainty about the analysis of avoided costs. The Commission may also depart from ECP in order to avoid rate shock if a new cost analysis shrinks the cost avoidance.

[31] If the starting point is averaged rates and disparate costs, then at the start institutional contributions are unequal. Under this circumstance ECP will equalize the unit institutional contributions and some rates necessarily will increase. This was the situation for Periodicals when worksharing discounts were introduced. Prior to that presorting was required but each presort tier paid the same averaged rate. Thus, some paid more and others paid less unit institutional costs. When discounts were installed and ECP was used for pricing, rates were deaveraged. The problem did not emerge in First-Class, or in advertising mail when carrier route was introduced, because few if any pieces were being presorted in First-Class or presorted to the carrier route in advertising mail before the discounts were put into effect.

Appendix 1

HISTORY OF ADVERTISING MAIL DISCOUNTS

Effective Date	Discount/Surcharge
1/28/79	Carrier Route Discount
3/22/81	5-Digit Discount
4/3/88	Basic ZIP+4 Discount, Letter Shaped Mail * 5-Digit ZIP+4 Discount, Letter Shaped Mail *
2/3/91	5-Digit Discount Changed to a Combined 3/5-Digit Discount Saturation Discount Basic Barcode Discount, Letter Shaped Mail 3-Digit Barcode Discount, Letter Shaped Mail 5-Digit Barcode Discount, Letter Shaped Mail Dropship Discounts for entry at DSCF, DBMC, and DDU
3/15/92	High Density Discount, Flat Shaped Mail Only
9/20/92	Basic Barcode Discount, Flat Shaped Mail 3/5-Digit Barcode Discount, Flat Shaped Mail
7/1/96	ZIP+4 Discounts Eliminated High Density Discount, Letter Shaped Mail Carrier Route Benchmark Changes (Reclassification Change)
1/10/99	Parcel Surcharge ** Carrier Route Barcode Discount, Letter Shaped Mail (Not Applicable to High Density or Saturation Mailings)
1/7/01	Parcel Barcode Discount, Basic and 3/5-Digit Only

Note: Advertising mail must be mailed in bulk quantities with a 200-piece minimum requirement and no mail piece can exceed one pound

* Discount for using 9-digit ZIP Code; subsequently replaced by 11-Digit Barcode

** Advertising mail includes merchandise samples and other items mailed as parcels subject to bulk mailing and maximum weight per piece requirements.

Appendix 2

Regression Analysis of the Impact of Worksharing Discounts

Discussion of Regression Results

The initial efficiency gains from worksharing discounts are not the only, and may not be the most important, stimulus to postal demand resulting from the Postal Service's renovations in its product offerings. The unbundling of basic mail services also has the delayed effect of promoting the development of better commercial technologies for generating and processing mail. Commercial mailing is actually a sequence of connected processes beginning with the generation of the mail, which is always performed by the mailer, and ending with delivery, which is always performed by the Postal Service. Between generation and delivery are intermediate collection, transportation, and mail processing activities. Prior to 1976 these intervening activities were performed exclusively by the Postal Service using a limited range of simple manual technologies. With the introduction of worksharing, commercial mailers had the opportunity to perform some of these activities for themselves. However, the gain to undertaking a worksharing activity depends upon the mailer having a cost advantage over the offered discount, or being able perform the activity with superior results. Thus worksharing discounts give mailers an incentive to develop specialized lower–cost technologies for the workshared activities.

The initial impact of a new worksharing discount is limited to mailers with a cost advantage conferred by the available technology. However, as specialized technologies are developed for performing intermediate activities more efficiently, mail volumes will grow as more commercial mailers discover a cost advantage to performing the activities themselves and accepting a discount. Since 1976 the Postal Service has encouraged the development of more efficient technologies for worksharing by adapting its own technology and regulations to smooth its interface with commercial mailers. The discounts for most kinds of worksharing also tended to increase in relation to the rate for undiscounted mail during the period prior to the general reclassification proceeding of 1995. So the economic incentive to develop better technologies for most

kinds of worksharing was maintained or increased by the rate structure for many years following the introduction of the discounts.

Although there is by now a fairly large body of anecdotal evidence to support the hypothesis that mail volumes have grown as a result of the Postal Service's innovations in its service offerings, the econometric forecasting models submitted by the Postal Service in rate proceedings are not designed to provide estimates of the impact of service innovations on postal volumes even though some use has recently been made of the hypothesis in specifying the equations. The Postal Service's volume models have typically incorporated discounts on workshared mail as elements of fixed-weight price indices for each subclass. The fixed-weight price indices are then included as explanatory variables in a system of demand equations that are fit at the subclass level. In effect, the models continue to treat volume in each subclass as a large composite embodying fixed proportions of all the basic services. In R97-1 this treatment was relaxed somewhat by the estimation of separate demand equations for composites of all workshared First-Class letters and all standard enhanced carrier route mail. In R2000-1 many of the demand equations were specified with dummy variables to capture the immediate proportionate impact of service innovations. However, these dummies are not capable of capturing growth effects from worksharing that are spread over time.

The Postal Service forecasts volumes by worksharing category by applying shares to its subclass volume forecasts. Since R90-1 these shares have also been derived econometrically from the discounts and other economic data. However, the Postal Service's share models only distribute the volumes from the demand equations without altering the total. So, the share models do not include any mechanism to measure the impact of service innovations on total volume.

Even a casual examination of the time series for several major classes and subclasses of mail is sufficient to indicate that service innovations have made an important contribution to volume growth since 1976. For example the volume per household of First-Class letters was declining from 1970 to 1976. However, volume per household leveled off between 1977 and 1982 and then grew rapidly but at a declining rate from 1982 to 1990. This growth pattern corresponds roughly to the growth path that one would expect to see from the introduction of discounts for basic 5-digit

presorting in 1976 and carrier-route presorting in 1981. Other subclasses of First-Class and third-class (Standard A) mail also exhibit growth paths with periods of rapidly rising and falling demand per household that seem much too large to be explained as the response of demand to the usual economic suspects such as rate and income changes. Like First-Class letters, these episodes appear to follow in the wake of innovations in service offerings by the Postal Service, major changes in postal rules, and crossovers in the relationship of rates between substitute services. Graphs of annual volumes per household between 1960 and 1998 are shown in an attachment for First-Class letters and cards and third-class letters and cards.

In 1996 the Commission staff and a consultant conducted a wide-ranging reexamination of the long-term causes of growth and change in mail volumes. Our attention soon focused on the role of the Postal Service's various worksharing programs and related changes in the rate structure and postal rules. We decided to conduct a kind of statistical experiment to see if an econometric model designed specifically to incorporate the effects over time of innovations in service offerings could explain the time paths for mail volumes per household for First-Class and third-class (now called Standard) mail. The result of this experiment was a surprise. It turned out to be possible to fit volume per household time series with simple demand equations based upon such a model with astonishing precision. In early 1999 the equations were refit to annual time series through 1998 with the results shown in the attached graphs. For most categories of presorted and unpresorted mail the actual and the predicted volumes per household correspond almost exactly. Even First-Class cards, a small subclass that cannot be fit very well with conventional demand equations, yielded a good fit. The graphs and charts at the end of the appendix give the fits and regression statistics.

In general the equations of the model employ as variables the conventional economic determinants of demand, deflated postal rates and real gross domestic product per household, plus a sparse set of exponential dummy variables to capture the effects of service innovations and other one time changes in postal regulations and rate structures. The equations were fit as logarithmic transforms using ordinary least squares. Thus the volume, price and income variables in the regressions are all natural logarithms. The logarithmic dummy variables are an adaptation of the zero-one dummy

variables that are commonly used in linear regressions to capture the effects of one-time shifts in the estimated relationship. The logarithmic dummies were designed to spread such shifts over the years following the event in a way that reflects the hypothesis that the proportion of the shift that occurs follows an exponential time path towards a limiting value. The exponential paths for the dummy variables for each equation are all determined by a starting date and by a single common parameter, "beta", which is approximately the annual rate at which the logarithm of volume for a category of mail approaches its limiting value with all other influences on demand held fixed.

The equation for First-Class letters contains a variable "PBC-90" that we can use to demonstrate the idea behind all of the exponential dummies in the fitted equations. PBC-90 is designed to provide an estimate of the impact of an important rule change that occurred in February 1991 as the result of the R90-1 general rate case. As a result of that case discounts for prebarcoding were extended to certain categories of presorted First-Class letters and cards. The value for beta that is used to compute the exponential dummy is 0.3393. The value of PBC-90 is zero for presorted letters prior to 1982, just as a conventional dummy variable would be. After February 3, 1982, PBC-90 follows an exponential time path towards the limiting value of one. The rate of convergence of the logarithm of presorted volume to its limiting value is 33.93 percent of the difference per year. Since the equation is fit to annual data, the integral over the year of the exponential time path is used as the value of PBC-90 for every observation after the first year. For the first year the value of PBC-90 is adjusted to account for the actual starting date. The actual values of PBC-90 for First-Class letters from 1992 to 1998 are 0.127, 0.377, 0.556, 0.684, 0.775, 0.840, 0.886, and 0.919. The equation for First-Class letters also includes exponential dummy variables for the introduction of discounts for 5-digit presorting in 1976 and carrier-route presorting in 1981. Both of these variables are defined similarly to PBC-90 and use the same value of beta. The same beta is also used as the rate of adjustment for a logistic trend "Z-98", centered on midyear 1989. Z-98 is designed to represent the effect of the adoption of electronic messaging over time on First-Class letters. The midpoint of June 30, 1998 is assumed to be the point at which half of the impact on the logarithm of letters per household was reached.

In addition to the exponential dummies, the model incorporates a simple mechanism to explain the volumes of mail that were shifted from nonpresort to presort categories following the creation of 5-digit and carrier-route categories of workshared mail. The mechanism assumes that a specific fraction, called “alpha”, of presorted mail has migrated from the nonpresort category. Alpha is assumed to be a fixed constant in the range zero-to-one for all years of the sample. For example, the alpha for First-Class letters is 0.4014. This means that 40.14 percent of the volume per household of presorted First-Class letters would return to the nonpresort category if the worksharing discounts for presorting First-Class letters were eliminated. Alpha is used to reconstruct the volume of nonprosorted mail that would have occurred in the absence of this form of worksharing. This is done in the obvious way by multiplying the predicted volume of presorted mail by alpha and adding the result to the actual observed volume of nonpresorted mail. This device leaves a uniformly defined time series for nonpresorted First-Class letters before and after the introduction of presorting.

Finally, to conserve degrees of freedom, observations for all presort categories of mail have been combined in single samples for each subclass. There are 39 observations for all of the nonpresort categories of mail but far fewer for any of the presort categories. Combining categories produces samples that range in size from 62 to 77 observations but carries a price in terms of the information extracted from the sample. Specifically, income and price elasticities are assumed to be the same for all categories of mail included in the combined sample. The errors for presorted and nonpresorted observations are also assumed to have the same variance and to be uncorrelated with each other. This arrangement allows equations with up to ten variables, including different intercepts for each presort category, to be effectively fit with the samples.

The equations of the model are nonlinear in the parameters alpha and beta, but are otherwise log-linear in the variables specified for each equation. Given alpha and beta, any of the equations can be fit by ordinary least squares. To estimate alpha and beta, least squares estimations were performed within a search algorithm to find the values of alpha and beta for each subclass that minimized the sum of the squared residuals. The results of this estimation procedure for First-Class letters, First-Class cards, third-class bulk regular rate, and third-class bulk nonprofit are summarized in the

set of attached tables. The R-squared statistics range from 0.979 to 0.998 thus confirming the visual impressions from the graphs. All of the estimated coefficients have reasonable signs and most have high t-values, including the price and income elasticities thus confirming the importance of these standard economic variables in the determination of postal volumes. The statistics are given in the charts at the end of the appendix.

However, it is the estimates of alpha, beta and the parameters of the exponential dummies that are the most interesting since these parameters have estimated values that confirm the hypothesis that innovations in service offerings have not just shifted subclass volumes among worksharing categories, but have actually caused increases in total subclass volumes over time. From 1976 through 1990, postal volumes in all of the five subclasses for which we have estimates benefited from a succession of postal service innovations that produced the appearance of long-term continuous growth. Since 1990 the innovations have come less regularly and the resulting growth has appeared less regular, particularly for First-Class letters and cards.

The estimates of alpha and beta for the subclasses are shown below.

Subclass	Alpha	Beta
First-Class Letters	0.4014	0.3393
First-Class Cards	1.0000	0.4373
Third-class Bulk Regular Rate	0.2599	0.4008
Third-class Bulk Nonprofit	0.5964	0.1966

Taken together, the estimates of alpha show that most presorted mail is new mail rather than old mail that has migrated from the corresponding lower presort category. The exceptions to this rule are the smaller subclasses of First-Class cards and third-class bulk nonprofit. In First-Class cards the estimate for alpha of one was inserted after the estimation procedure failed to converge. In third-class bulk nonprofit the alpha of 0.5964 shows that only 59.64 percent of carrier-route and 3/5-digit presort has migrated from required presort.

The estimates of beta show that the effects of innovations in postal pricing and service offerings take several years to develop. All of the values of beta in the table are low enough to produce exponential dummy variables that stretch the impact of an innovation over 5 to 10 years. This is entirely consistent with the argument made earlier that much of the impact of worksharing depends upon the development of more efficient mailer technologies for the workshared activities. Developing and adapting better technologies takes time and would easily account for the delayed reaction of most mailers to the Postal Services' innovations. Technically, the low betas mean that the effects of service innovations cannot be accurately measured by a system of simple dummy variables as one finds in the most recent Postal Service demand models. The estimated coefficients of these dummies will average the effects of innovations over the observations following their introduction. Since this averaging includes years before mailers have fully adapted to the innovations, the estimated coefficients of the simple dummies will generally understate of the long-term impact of the innovations. A collection of simple dummies will also lead to confusion of the time paths caused by innovations with autonomous trends and high levels of apparent serial correlation in the misspecified equation errors. The model used to fit the attached regressions avoids these problems.

The importance of specific service innovations and other structural changes in postal rules and rates is strongly confirmed for every subclass in the experiment by the estimates of the coefficients for the exponential dummy variables. These estimates, along with their estimated standard errors and t-values, are shown in the attached tables. The coefficient estimates are least squares estimates that have been computed for the values of alpha and beta shown above. Consequently, the standard deviations and t-values do not account for the uncertainty surrounding the estimates of alpha and beta. Nevertheless, the t-values are so high in most cases that any values of alpha and beta chosen within a fairly wide range of the values used will not have much effect on the findings.

First-Class Letters

The estimates demonstrate that the original introduction of 3/5-digit presorting in 1976, the introduction of carrier-route presorting in 1981, and the extension of discounts for prebarcoding in 1991 initiated statistically significant exponential growth processes in the demand for presorted First-Class letters. Only about 40 percent of this growth seems to have been a migration of letters from the nonpresorted category. The remaining 60 percent either migrated from mail subclasses other than First-Class letters, or, more likely, was simply new mail in the system. The estimates also show that First-Class letters are in the midst of a downward logistic trend that is probably attributable to the adoption of communications technologies, fax and e-mail, that compete with First-Class mail. The estimates show that the original introduction of 3/5-digit presorting dwarf in importance the effects of the other innovations and the logistic trend. In effect, the original strong impetus to demand from 3/5 digit presorting was given much weaker helping nudges by the other innovations through the early 1990s. At that point the effects of the innovations approached their limits leaving a time path for First-Class letters per household that has been increasingly dominated by the incursions of electronic messaging.

First-Class Cards

First-Class cards have been significantly affected by most of the growth processes that were found to affect First-Class letters and by two others as well. The additions are, first, the effect of new rules introduced after the MC95 reclassification case, and, second, the effect of two occasions when the First-Class card rate has crossed over and been set lower than the rate for third-class bulk regular rate cards. The alpha of one means that the subclass as a whole is not a net beneficiary of presorting. All of the volume of presorted cards appears to have migrated from the nonpresort category. The introduction of 3/5-digit presorting precipitated further losses in nonpresorted cards, probably to presorted First-Class letters. The advent of carrier-route presorting had little effect on First-Class cards and a corresponding exponential dummy has been omitted from the estimated equation shown in the attachments. After the introduction of presorting, perhaps the most striking example of a growth process

induced by structural change can be found in the effect of rate crossovers on volumes per household of First-Class cards. The First-Class and third-class bulk regular card rates crossed over between 1988 and 1991 and between 1995 and the end of the sample in 1998. During these periods the volumes of both presorted and nonpresorted cards increased along an exponential growth path. In the interval between the crossovers the process worked in reverse and volume per household decreased along the exponential path. The estimated equation uses a single "Crossover" dummy variable that combines the effects of switching the crossover on, off, and then on again. The estimated coefficient for the variable is positive, large and has a t-value of 8.41. The estimates also show that the rules changes that followed MC95 are significantly depressing First-Class card volumes.

Third-class Bulk Regular Rate

The introduction of presorting for First-Class letters and cards in 1976 depressed third-class bulk required presort mail. However, this effect was largely overshadowed by the introduction of third-class carrier route presorting in 1979 and, to a lesser extent, by 3/5-digit presorting in 1981. These introductions set off the newly created categories of carrier-route and 3/5-digit presort on growth paths that can be fit with great accuracy with the model. The Rule changes following the 1987 rate case also triggered a strong and highly significant growth process in 3/5-digit presorted mail. The rule changes following the 1995 mail classification case triggered a smaller but still significant growth process in carrier-route presorted mail. The alpha for the third-class bulk regular subclass is only 26 percent, so relatively little of the growth in 3/5-digit and carrier-route presorted third-class bulk regular mail has come at the expense of required presort.

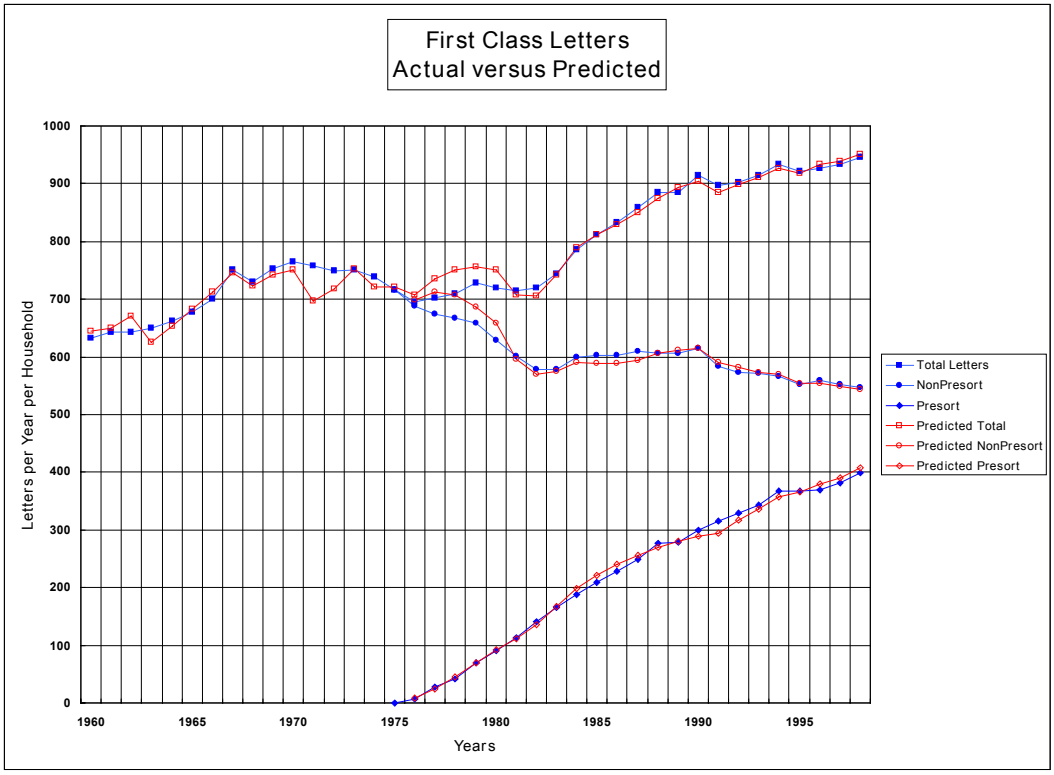
Third-class Bulk Non-Profit

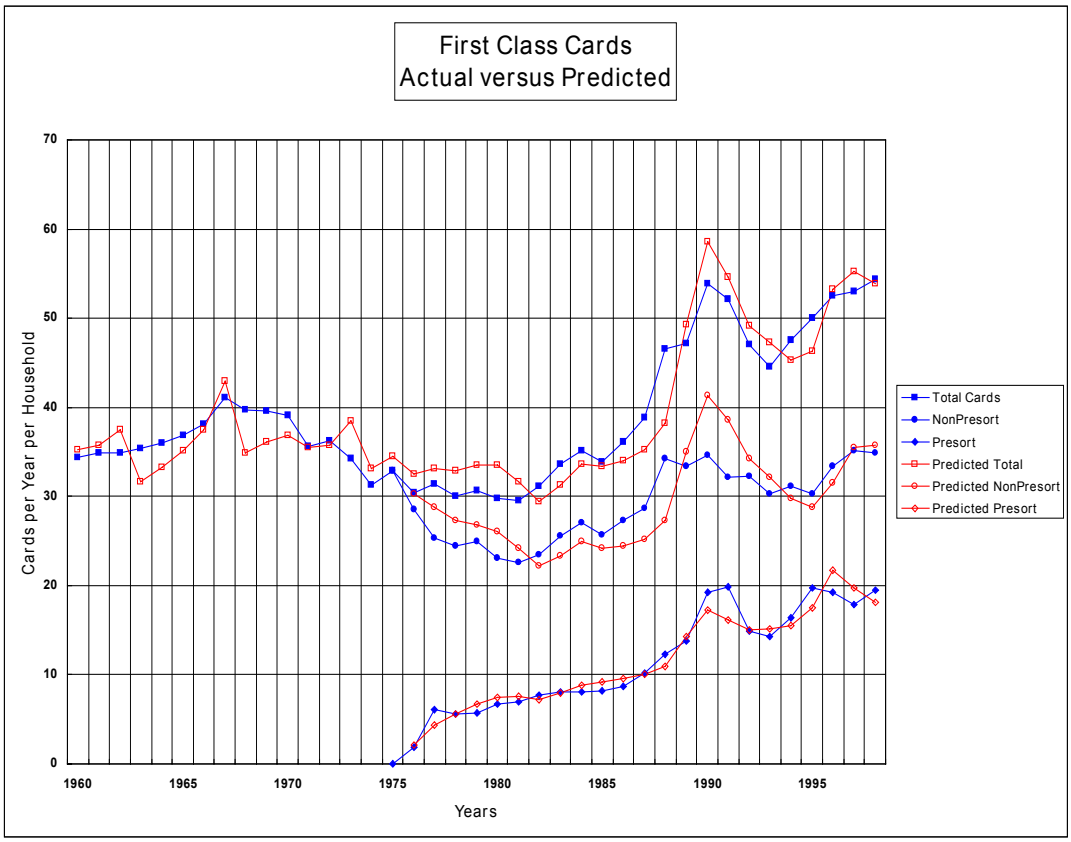
Third-class bulk non-profit mail has been subject to most of the same service innovations as bulk regular but non-profit mailers appear to have reacted somewhat differently to the changes. The introduction of First-Class presorting had little effect on third Class bulk non-profit and no exponential dummy has been included for it. Like regular rate, the introduction of carrier-route and 3/5-digit presorting initiated growth paths for these categories that the exponential dummies represent quite accurately. In

this case the effect of the introduction of 3/5-digit presorting had a greater impact than the introduction of carrier-route presorting. As with bulk regular rate, rule changes following the 1987 rate case had a significant and positive effect on 3/5-digit presort. The extension of prebarcoding discounts following the 1990 rate case seems to have mildly depressed both the required presort and the 3/5-digit presort categories while the rule changes following the mail reclassification case of 1995 appear to have set off a strong new growth process in carrier-route presort. With an alpha of 60 percent, much of the growth in the carrier-route and 3/5-digit categories can be seen to be coming from required presort. This basically explains why the entire subclass of third-class bulk regular rate has grown much more rapidly than bulk non-profit since the inception of presorting for these subclasses in 1979.

Regression Results

The regression results are presented in the following graphs and charts for each of the mail categories examined. The graphs plot actual outcomes versus the predicted regression line and the charts give the regression statistics.


First Class Letters
Actual versus Predicted
Letters per Year per Household
Years
Total Letters
NonPresort
Presort
Predicted Total
Predicted NonPresort
Predicted Presort


First Class Cards
Actual versus Predicted
Cards per Year per Household
Years
Total Cards
NonPresort
Presort
Predicted Total
Predicted NonPresort
Predicted Presort

Regression Output: **First-Class Letters**
Volume per Household

Constant	None	DW Statistic	2.2738
Std Err of Y Est	0.041042	Alpha	0.4014
R Squared	0.998163	Beta	0.3393
No. of Observations	62		
Degrees of Freedom	53		

	NonPresort	Presort	3rd Price	GDP	Own Price	Presort Intro	C-R Presort	PBC 90	Z-98
X Coefficient(s)	3.4820	2.0739	0.3418	0.7573	-0.5696	3.2227	0.3266	0.2214	-0.3904
Std Err of Coef.	0.4972	0.5163	0.0594	0.1069	0.0830	0.0732	0.0433	0.0341	0.0819
t-Value	7.0024	4.0170	5.7524	7.0835	-6.8645	44.0095	7.5360	6.4909	-4.7660

General: Volume, Price and Income variables as used in the regressions are natural logarithms. Therefore, the coefficients of the Price and Income variables are estimated elasticities. The sample consists of annual observations of NonPresort letters from 1960 to 1998 and of Presort letters from 1976 to 1998. All observations have been converted to calendar years.

Y Variable: NonPresort and Presort Volumes of First Class Letters per Household per Year. From 1976 to 1998 the NonPresort Volume includes an estimate of the component (the Transfer) that has migrated to Presort.

X Variables: NonPresort - Equation intercept for NonPresorted letters.

Presort - Equation intercept for Presorted letters.

3rd Price - Fixed Weight Price Index of Third-Class Bulk Regular Rate mail divided by the implicit deflator for Gross Domestic Product.

GDP - Gross Domestic Product per Household in chained 1992 dollars.

Own Price - Fixed Weight Price Index of First Class NonPresort letters or Presort letters divided by the implicit deflator for Gross Domestic Product.

Presort Intro - Exponential trend for Presorted letters beginning with the introduction of presorting in 1976. The variable has an initial value of minus one and grows exponentially over time to a limiting value of zero.

C-R Presort - Exponential dummy variable for Presorted letters beginning with the introduction of Carrier-Route presorting in 1981. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

PBC 90 - Exponential dummy variable for Presorted letters beginning with the extension of prebarcoding discounts to certain categories of presorted letters following the R-90 General Rate Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

Z-98 - Logistic Trend for NonPresorted letters with an inflection point at midyear of 1998. The Z-98 variable is designed to represent the adoption over time of electronic messaging technologies such as fax and e-mail. The position of the inflection point implies that approximately one-half of the total adjustment in the volume of NonPresorted First-Class Letters occurred up to July 1998.

Parameters: Alpha - The estimated proportion of Presorted mail that has migrated from NonPresort. Alpha is estimated (along with Beta) by minimizing the residual sum of squares. Alpha times predicted Presorted Volume is referred to as the "Transfer" and is added to NonPresorted letters after 1976 to produce a time series for estimation that is consistent with reported volumes of letters from 1960 to 1975.

Beta - The annual rate used to compute the exponential trend "Presort Intro" and the exponential dummy variables "C-R Presort" and "PBC 90". Beta is estimated (along with Alpha) by minimizing the residual sum of squares. Beta is approximately the annual rate at which actual volume adjusts towards its limiting value over time (the volume "Ceiling"). Beta is also used as the annual rate of adjustment for the logistic variable "Z-98".

Regression Output: **First Class Cards**
Volume per Household

Constant	None	DW Statistic	1.5778
Std Err of Y Est	0.101284	Alpha	1.0000
R Squared	0.983530	Beta	0.4373
No. of Observations	62		
Degrees of Freedom	52		

	NonPresort	Presort	GDP	Own Price	1st Presort	Presort Intro	Crossover	PBC 90	MC-95	Z-98
X Coefficient(s)	-1.7274	-3.2908	1.0043	-0.7394	-0.1788	1.0629	0.7488	0.4132	-0.9344	-1.4833
Std Err of Coef.	1.2644	1.3167	0.2725	0.1741	0.0564	0.1237	0.0890	0.0703	0.2050	0.2434
t-Value	-1.3661	-2.4993	3.6855	-4.2462	-3.1725	8.5935	8.4162	5.8788	-4.5577	-6.0934

General: Volume, Price and Income variables as used in the regressions are natural logarithms. Therefore, the coefficients of the Price and Income variables are estimated elasticities. The sample consists of annual observations of NonPresort cards from 1960 to 1998 and of Presort cards from 1976 to 1998. All observations have been converted to calendar years.

Y Variable: NonPresort and Presort Volumes of First Class cards per Household per Year. From 1976 to 1998 the NonPresort Volume includes an estimate of the component (the Transfer) that has migrated to Presort.

X Variables:

NonPresort - Equation intercept for NonPresort mail.

Presort - Equation intercept for Presorted mail.

GDP - Gross Domestic Product per Household in chained 1992 dollars.

Own Price - Fixed Weight Price Index of First Class NonPresort cards or Presort cards divided by the implicit deflator for Gross Domestic Product.

1st Presort - Exponential trend for NonPresorted cards beginning with the introduction of presorting in 1976. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

Presort Intro - Exponential trend for Presorted cards beginning with the introduction of presorting in 1976. The variable has an initial value of minus one and grows exponentially over time to a limiting value of zero.

Crossover - Exponential dummy variable representing the effect of the crossover in rates between Third Class BRR cards and First Class Presort cards between 1988 and 1991 and after 1994. The variable has an initial value of zero and grows exponentially toward a limiting value of one between 1988 and 1991. Thereafter, the value reverses and declines exponentially towards zero. In 1995 the exponential trend begins again and proceeds towards a limiting value of one.

PBC 90 - Exponential dummy variable for all First Class cards beginning with the extension of prebarcoding discounts to certain categories of First Class cards following the R-90 General Rate Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

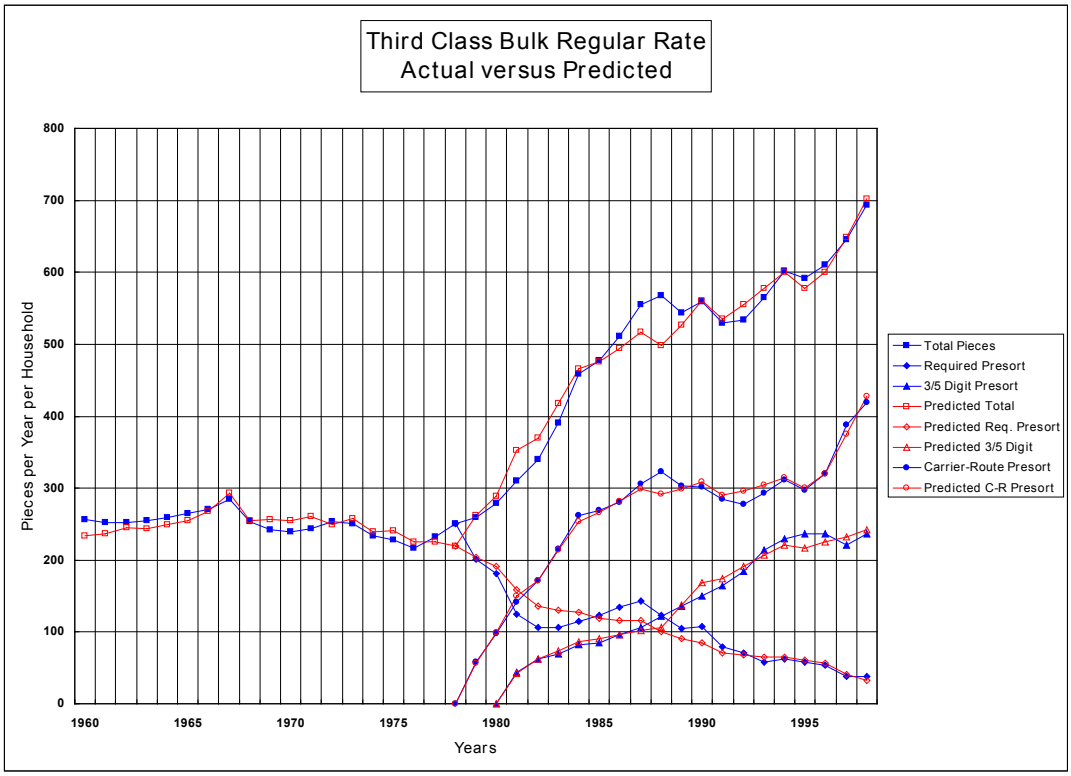
MC-95 - Exponential dummy variable for Presorted mail beginning with the introduction of new rules and rate-schedule changes following the MC-95 Mail Classification Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

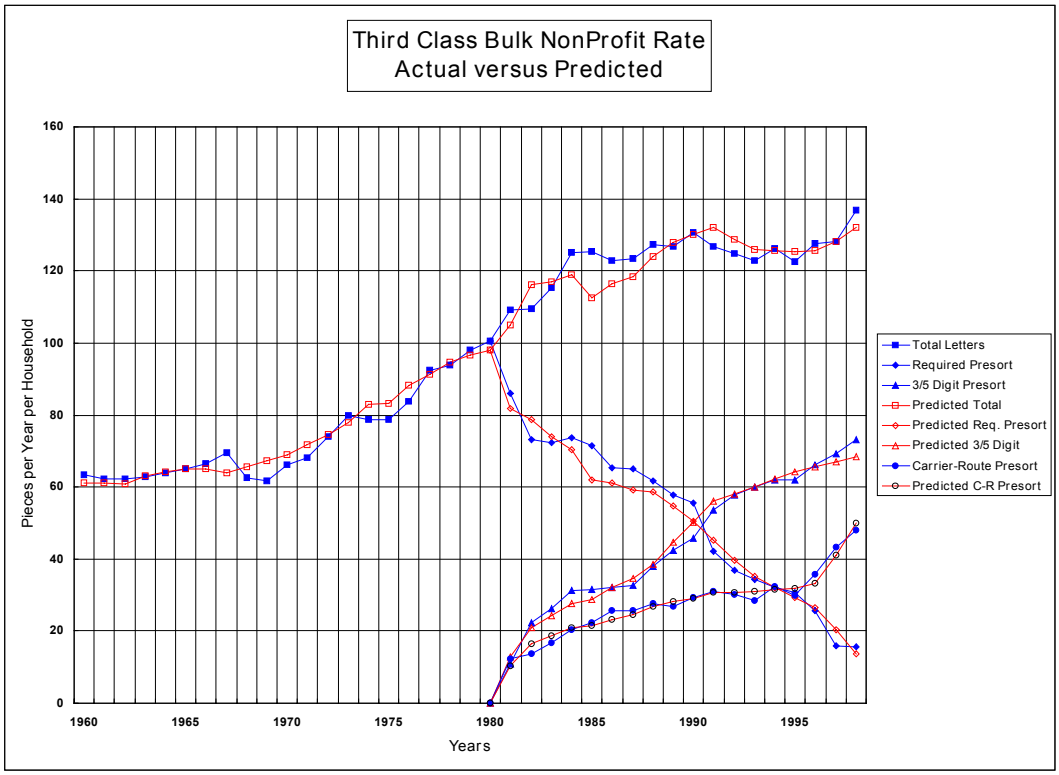
Z-98 - Logistic Trend for NonPresorted letters with an inflection point at midyear of 1998. The Z-98 variable is designed to represent the adoption over time of electronic messaging technologies such as fax and e-mail. The position of the inflection point implies that approximately one-half of the total adjustment in the volume of NonPresorted First-Class Letters occurred up to July 1998.

Parameters:

Alpha - The estimated proportion of Presorted mail that has migrated from NonPresort. Alpha is taken as one. Attempts to estimate Alpha (along with Beta) by minimizing the residual sum of squares produced values greater than one. Alpha times predicted Presorted Volume is referred to as the "Transfer" and is added to NonPresorted cards after 1976 to produce a time series for estimation that is consistent with reported volumes of cards from 1960 to 1975.

Beta - The annual rate used to compute the exponential trends "1st Presort" and "Presort Intro", and the exponential dummy variables "Crossover" and "PBC 90". Beta is estimated by minimizing the residual sum of squares. Beta is approximately the annual rate at which actual volume adjusts towards its limiting value over time (the volume "Ceiling"). Beta is also used as the annual rate of adjustment for the logistic variable "Z-98".


Third Class Bulk Regular Rate
Actual versus Predicted
Pieces per Year per Household
800
700
600
500
400
300
200
100
0
1960
1965
1970
1975
1980
1985
1990
1995
Years
Total Pieces
Required Presort
3/5 Digit Presort
Predicted Total
Predicted Req. Presort
Predicted 3/5 Digit
Carrier-Route Presort
Predicted C-R Presort


Third Class Bulk NonProfit Rate
Actual versus Predicted
Pieces per Year per Household
160
140
120
100
80
60
40
20
0
1960
1965
1970
1975
1980
1985
1990
1995
Years
Total Letters
Required Presort
3/5 Digit Presort
Predicted Total
Predicted Req. Presort
Predicted 3/5 Digit
Carrier-Route Presort
Predicted C-R Presort

Regression Output: **Third-Class Bulk Regular Rate Volume per Household**

Constant	None	DW Statistic	0.7690
Std Err of Y Est	0.064991	Alpha	0.2599
R Squared	0.978962	Beta	0.4008
No. of Observations	77		
Degrees of Freedom	67		

	Req Presort	3/5 Presort	C-R Presort	GDP	Own Price	3/5 Intro	C-R Intro	R-87 Rule	MC-95	1st Presort
X Coefficient(s)	1.4976	0.4581	1.4556	0.7813	-0.4834	0.6773	1.8606	0.8404	0.4313	-0.2236
Std Err of Coef.	0.8355	0.8727	0.8863	0.1739	0.0972	0.0896	0.0798	0.0506	0.1190	0.0357
t-Value	1.7924	0.5250	1.6423	4.4936	-4.9754	7.5609	23.3123	16.6252	3.6252	-6.2683

General: Volume, Price and Income variables as used in the regressions are natural logarithms. Therefore, the coefficients of the Price and Income variables are estimated elasticities. The sample consists of annual observations of Required Presort letters from 1960 to 1998, of 3/5 Digit Presorted letters from 1981 to 1998 and of Carrier-Route Presorted letters from 1979 to 1998. All observations have been converted to calendar years.

Y Variable: Required Presort, 3/5 Digit Presort and Carrier-Route Presort Volumes of Third-Class Bulk Regular Rate mail per Household per Year. From 1979 to 1998 the Required Presort Volume includes an estimate of the component (the Transfer) that has migrated to 3/5 Digit and Carrier-Route Presort.

X Variables:

Req Presort - Equation intercept for Required Presort mail.

3/5 Presort - Equation intercept for 3/5 Digit Presorted mail.

C-R Presort - Equation intercept for Carrier-Route Presorted mail.

GDP - Gross Domestic Product per Household in chained 1992 dollars.

Own Price - Fixed Weight Price Index of Third Class Bulk Regular Rate Required Presort mail, 3/5 Digit Presort mail or Carrier-Route Presorted mail divided by the implicit deflator for Gross Domestic Product.

3/5 Intro - Exponential trend for 3/5 Digit Presorted mail beginning with the introduction of 3/5 Digit presorting in 1981. The variable has an initial value of minus one and grows exponentially over time to a limiting value of zero.

C-R Intro - Exponential trend for Carrier-Route Presorted mail beginning with the introduction of Carrier-Route presorting in 1979. The variable has an initial value of minus one and grows exponentially over time to a limiting value of zero.

R-87 Rule - Exponential dummy variable for 3/5 Digit Presorted mail beginning with the introduction of rules changes following the R-87 Rate Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

MC-95 - Exponential dummy variable for Carrier-Route Presorted mail beginning with the introduction of new rules and rate-schedule changes following the MC-95 Mail Classification Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

1st Presort - Exponential dummy variable for Required Presort mail beginning with the introduction of 1st Class presorting in 1976. The variable has an initial value of zero and grows exponentially over time to a a limiting value of one.

Parameters:

Alpha - The estimated proportion of 3/5 Digit and Carrier-Route Presorted mail that has migrated from Required Presort. Alpha is estimated (along with Beta) by minimizing the residual sum of squares. Alpha times predicted 3/5 Digit and C-R Volume is referred to as the "Transfer" and is added to Required Presort letters after 1978 to produce a time series for estimation that is consistent with reported volumes of letters from 1960 to 1978.

Beta - The annual rate used to compute the exponential trends "3/5 Intro" and "C-R Intro", and the exponential dummy variables "R-87 Rule", "MC-95" and "1st Presort". Beta is estimated by minimizing the residual sum of squares. Beta is approximately the annual rate at which actual volume adjusts towards its limiting value over time (the volume "Ceiling").

Regression Output: **Third Class Bulk NonProfit**
Volume per Household

Constant	None	DW Statistic	1.4274
Std Err of Y Est	0.063969	Alpha	0.5964
R Squared	0.988723	Beta	0.1966
No. of Observations	75		
Degrees of Freedom	65		

Volume/H'hold	Req Presort	3/5 Presort	C-R Presort	2nd NP Price	Own Price	3/5 Intro	C-R Intro	R-87 Rule	PBC 90	MC-95
X Coefficient(s)	4.7739	4.0691	3.6068	0.3172	-0.2289	1.1810	0.9597	0.5643	-0.2061	1.2763
Std Err of Coef.	0.1072	0.1014	0.1111	0.0218	0.0525	0.1035	0.0673	0.0894	0.0567	0.1955
t-Value	44.5459	40.1227	32.4625	14.5762	-4.3631	11.4138	14.2683	6.3091	-3.6334	6.5282

General: Volume, Price and Income variables as used in the regressions are natural logarithms. Therefore, the coefficients of the Price and Income variables are estimated elasticities. The sample consists of annual observations of Required Presort letters from 1960 to 1998, of 3/5 Digit Presorted letters from 1981 to 1998 and of Carrier-Route Presorted letters from 1981 to 1998. All observations have been converted to calendar years.

Y Variable: Required Presort, 3/5 Digit Presort and Carrier-Route Presort Volumes of Third-Class Bulk NonProfit Rate mail per Household per Year. From 1981 to 1998 the Required Presort Volume includes an estimate of the component (the Transfer) that has migrated to 3/5 Digit and Carrier-Route Presort.

X Variables:

Req Presort - Equation intercept for Required Presort mail.

3/5 Presort - Equation intercept for 3/5 Digit Presorted mail.

C-R Presort - Equation intercept for Carrier-Route Presorted mail.

2nd NP Price - Fixed Weight Price Index of Second Class NonProfit Mail divided by the implicit deflator for Gross Domestic Product.

Own Price - Fixed Weight Price Index of Third Class Bulk Nonprofit Rate Required Presort mail, 3/5 Digit Presort mail or Carrier-Route Presorted mail divided by the implicit deflator for Gross Domestic Product.

3/5 Intro - Exponential trend for 3/5 Digit Presorted mail beginning with the introduction of 3/5 Digit presorting in 1981. The variable has an initial value of minus one and grows exponentially over time to a limiting value of zero.

C-R Intro - Exponential trend for Carrier-Route Presorted mail beginning with the introduction of Carrier-Route presorting in 1979. The variable has an initial value of minus one and grows exponentially over time to a limiting value of zero.

R-87 Rule - Exponential dummy variable for 3/5 Digit Presorted mail beginning with the introduction rules changes following the R-87 Rate Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

PBC 90 - Exponential dummy variable for Required and 3/5 Digit Presort mail beginning with the extension of prebarcoding discounts to certain categories of Required and 3/5 Digit Presort NonProfit mail following the R-90 General Rate Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

MC-95 - Exponential dummy variable for Carrier-Route Presorted mail beginning with the introduction of new rules and rate-schedule changes following the MC-95 Mail Classification Case. The variable has an initial value of zero and grows exponentially over time to a limiting value of one.

Parameters:

Alpha - The estimated proportion of 3/5 Digit and Carrier-Route Presorted mail that has migrated from Required Presort. Alpha is estimated (along with Beta) by minimizing the residual sum of squares. Alpha times predicted 3/5 Digit and C-R Volume is referred to as the "Transfer" and is added to Required Presort letters after 1981 to produce a time series for estimation that is consistent with reported volumes of letters from 1960 to 1980.

Beta - The annual rate used to compute the exponential trends "3/5 Intro" and "C-R Intro", and the exponential dummy variables "R-87 Rule" , "PBC 90" and "MC-95". Beta is estimated by minimizing the residual sum of squares. Beta is approximately the annual rate at which actual volume adjusts towards its limiting value over time (the volume "Ceiling").