Postal Worksharing:
Welfare, Technical Efficiency, and Pareto Optimality

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Introduction

Competition is generally believed to lead to efficiency, be it economic or technical. One method of introducing competition into postal systems, without affecting the universal service obligation, is through what have been termed "worksharing" discounts. One begins with the view that the postal system is a vertically integrated network involving the collection, sorting, transporting, and final delivery of mail. Under the presumption that the postal monopoly applies in its clearest form only to the final delivery process, where scale economies are likely the greatest, the worksharing notion is that a discount should be offered to mailers or competitors[1] who do portions of the postal work and then turn the mail over to the postal service for completion of delivery. As a technical matter, it should be noted up front that there is no requirement that the mailer or the competitor really perform any particular piece of work, only that the mail be presented so that the postal service[2] does not have to do that piece of work. In terms of understanding the functioning and effects of the worksharing process, this distinction will be shown to be a matter of some importance.

Because simplicity and ease of administration are usually given some weight in rate setting, the number of worksharing discounts is limited. Such a limitation might not exist in the private sector, where the categories of customers to be served can be prescribed and contract rates can be tailored to specific customers or situations, but it is taken as a constraint on broad-based government organizations.[3] Given this limitation, attention focuses on several obvious questions: (1) Should worksharing discounts be offered? (2) What are the effects of these discounts on mailers and on the Nation? (3) How should the size of these discounts be determined? This paper answers the first primarily in terms of the second. The framework within which these issues will be considered is the existing United States postal system, about which the author knows a little.

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[1] The term competitors stands for private firms that compete for portions of postal work, possibly as contractors or agents of mailers or mailing organizations.

[2] The term postal service is a reference to a country's dominant or government-run postal delivery system. References to the United States Postal Service will be capitalized.

[3] This paper refers almost interchangeably to rate(s) and price(s). The former term is more common in postal rate circles and the latter more common in economics.

Needless to say, these issues involve much more than just the fringes of postal activity. In the United States, almost half of the First-Class mailstream is workshared and an even larger portion of Standard A[4] is either workshared or has preparation requirements that involve work the mailer must do. Accordingly, the number of dollars involved in worksharing is in the billions and the effects on mailers and the economy are quite large. Also, considerable sums are spent by the Postal Service analyzing the costs associated with worksharing, and mailers/competitors incur considerable expense litigating their positions on worksharing before the Postal Rate Commission.

Although competition and efficiency are important, and may be the bottom line, the movement toward worksharing has been guided by other justifications as well. Recognizing that these other justifications overlap and may not all qualify as basic starting points, it is worthwhile to list them. First, there are those who argue that worksharing is a kind of deaveraging, which brings prices closer to costs, and that deaveraging is both economically efficient and fair. Second, there is the view that worksharing discounts are needed to make the postal service more competitive, thus helping to stave off threats from competing carriers and electronic substitutes. Third, there are arguments that worksharing discounts are needed to send signals to mailers that allow the mailers to decide whether they or their agents can do the work for less than the postal service.[5] Fourth, there are those who argue that worksharing discounts are a natural outcome of traditional "make or buy" decisions. That is, businesses commonly contract out any function that can be done by another firm at a lower cost. Fifth, some parties take the Efficient Component Pricing (ECP) rule as one that should be applied wherever opportunity presents itself. Within ECP, there are four possibilities: set the discount equal to the simple cost difference between the two categories; set the discount equal to the average incremental savings in

[4] Due to a name change which is difficult to explain and is confusing, Standard A mail is the same mail that was formerly identified as Third Class. It consists primarily of advertising mail that is not required to be sent First Class. It also includes some mail that might be viewed as community newspapers or shoppers and some that could be viewed as Periodicals. As a formal matter, Standard A mail in the United States is broken into two subclasses, one called Regular Standard A and the other called Enhanced Carrier Route Standard A. This paper will have some implications for this distinction, but will not focus specifically on it.

[5] The achievement of having the lowest cost person do the work is sometimes referred to as an outcome of "lowest combined cost."

cost associated with the worksharing program; set the price of the workshared product equal to its marginal cost plus the unit opportunity cost of the worksharing program; or set the discount equal to the savings *at the margin*.[6] Finally, there is the notion that it is fair to provide nondiscriminatory downstream access to the delivery network. This notion argues that the postal service should charge competitors the same amount to use the delivery system that the postal service charges itself. Since the author has not been able to figure out how much the postal service charges itself for delivery, this notion, while sounding meritorious and politically correct, will not be mentioned again.

These various approaches sometimes lead to different discount levels and different associated sets of effects. Also, they sometimes break down in application, when faced with a practical situation that does not align well with the assumptions of the approach. Short of that, the information required to apply them can be subject to wide margins of error and can be costly to develop.

This paper has four parts. The first part discusses various kinds of worksharing. The point is that mailers respond to "worksharing" discounts in a variety of ways and for a range of reasons, and that these responses need to be understood in order to understand the effects of the discounts. The second part is empirical and discusses various welfare aspects of selecting discount levels for First-Class Mail in the United States. The entire discussion is based on an econometric model which provides no-shift elasticities,[7] discount elasticities, and, by implication, own-price elasticities and cross-price elasticities for basic mail and workshared mail. This model is viewed as good for limited changes in prices and discount levels. The third part of the paper takes a broader view and considers welfare, efficiency, and fairness issues, consistent with the model in part two of the overall worksharing program for First-Class Mail. Part IV contains concluding observations. The focus in all three parts is on real numbers and on how the system is believed by the author to behave.

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[6] When the workshare price is equal to the marginal cost plus the unit opportunity cost, it is often observed that the postal service is "indifferent" to whether the workshare program is offered. When the discount is equal to the savings at the margin, as much work as possible will be transferred to the lower cost provider.

Part I: Aspects of Worksharing

In the middle 1970s, the rates for First-Class Mail and third-class mail in the United States were very simple. First-Class Mail in 1975 paid 10¢ per piece (plus another 9¢ for each additional ounce beyond the first), regardless of the piece's shape or processing characteristics, and regardless of the distance it needed to be carried. Similarly, third-class mail paid 41¢ per pound with a minimum charge of 7.9¢ per piece. It could be letter-sized, flat-sized, or parcel shaped; it could go 3,000 miles or across the street; it could be mixed in a sack with other pieces or it could be in a bundle for a specific 5-digit ZIP Code. In all cases, the rate was the same.

Now, the situation is quite different. The rate for the First-Class piece depends on whether it is presorted, on whether it qualifies for an automation category, on whether it is a letter or a flat within the automation category, on which of 6 presort levels it achieves within the automation category, and on whether it is nonstandard in shape. Further, the rate for additional ounces is considerably less than the rate for the first ounce. The rates for third class (now Standard A) are similar but even more complex. One must know whether the piece is a letter or a nonletter, whether it qualifies for an automation category, whether it qualifies for a carrier route presorted category, where it is entered in the system, what its presort level is, what its weight is, and whether it qualifies as saturation or near saturation. In the latter case, it must be prepared in what is called the line-of-travel, which is basically the sequence in which the carrier delivers his or her route, and there are other requirements as well.

These various price differences, all of which are based to some degree at least on studies of actual cost differences, send a wide range of signals to mailers. Some of these signals call for a decision on whether to workshare and others do little more than tell the mailer that some pieces cost more to process than others. But whatever their character or however they are viewed, the effects on mailers and on the mailstream have been

[7] As will be explained further below, a no-shift elasticity is an own-price elasticity under the constraint either that mailers may not shift to and from the workshared category or that the size of the workshare

enormous. Mailers are now presorting their mail, barcoding their mail, changing flat-size pieces into letter-size pieces, consolidating their mail, and carrying their mail great distances in order to enter it at specific locations. Presort firms are collecting the mail, working with their customers on the quality of their addresses and on the machinability of their addresses, sorting the mail, and entering the mail effectively. Private trucking firms have begun operations to do nothing more than carry mail across the country.

Viewed simply, four specific discounts are now being offered. The first is for presorting, the second for putting on barcodes and assuring machinability, the third for drop shipping, and the fourth for being letter-sized instead of flat-sized. Potentially more interesting, however, is to view the discounts in terms of the responses they receive from mailers and the factors associated with those responses. For this purpose, a classification of worksharing types is proposed, with no requirement that the types be mutually exclusive. This will aid in understanding mailer responses and in evaluating the benefits of offering the discounts.

Type-1 Worksharing. Type-1 worksharing is the simplest kind and is most closely aligned with the plain meaning of the term "workshare." The discount is given when the mailer or competitor does some of the postal work *and does it in essentially the same way as the postal service would do the work.* For example, a discount could be given for mail presorted into packages, each package being for one 5-digit ZIP Code area. In a type-1 worksharing situation, the mailer or competitor would sort the mail in essentially the same way that the postal service would sort the mail. This means collecting the mail and sorting it either by hand or on a sorting machine. Such a machine might have an optical character reader and might put on a barcode.

The purpose here is not to provide reasons or to quantify why the mailer/competitor might be able to do the work for less than the postal service, despite the likelihood that the mailer/competitor's scale of operations will be smaller. Several possible reasons, however, are clear. The mailer/competitor might pay lower wages than the postal service, might succeed in managing and/or scheduling more tightly the sorting operations, might achieve higher productivity levels, and might be working with a more

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discount does not change.

uniform and more tightly controlled mailstream. The latter factor exists because postal systems need to be designed to handle a wide range of mailpieces, generated by a wide range of mailers. Such operations tend to be higher in cost and may be more difficult to control.

A drop-ship discount might also evoke type-1 worksharing activity. A mailer sending a quantity of mail to zone 8 might achieve a lower rate if he carries the mail to the destination mail facility. If he can transport the mail for less than the discount, he will choose to do so. His success in performing the work at a lower cost might be due to an ability to arrange completely full trucks or to achieve lower-price contracts with trucking firms. The latter possibility might exist if the mailer assumed some risk by placing fewer constraints on the trucking operator.

In pure type-1 worksharing, the analysis of the decision and the benefits is simple. If the mailer/competitor can do the work at a lower cost, he will choose to do it. His welfare level will be increased by the difference between the discount and his cost of doing the work. The profit position of the postal administration depends on how the discount level is set, an issue that we need not specify here.

Type-2 Worksharing. In a type-2 situation, the mailer/competitor achieves the workshared result but *does the work in a different way from the way the postal service would do it*. The best example of type-2 worksharing involves, again, presort discounts. Either physically or electronically, the mailer may be able to arrange all of his addresses in ZIP Code order. This being done, he can then print together and bundle all of the addresses for one ZIP Code. After this, the addresses in another ZIP Code would be printed.

When a worksharing situation of this kind is faced, there is the potential for the mailer to do the work at *considerably* less cost than could the postal service. Even if he is sorting the addresses by hand, he has the option of doing the work in a completely different way Also, if the same mailing list is used more than once, or is used again with slight modification, he can sort once and do many mailings. As a practical matter, mailers are believed in many cases to be able to do this work for a fraction of the cost the postal

service would face. As a guess, this fraction could easily be in the neighborhood of one-quarter to one-eighth.

Two features of this kind of situation deserve note. First, the mailer may be able to do in one step what the postal service does in two or more steps. Such would be the case if the postal service requires two sortations to get the mail to the 5-digit level while the computer goes there directly. Second, mailers of some volume may be in position to take advantage of this discount without the help of a presort bureau or mailing firm.

From a welfare point of view, a type-2 discount situation is extremely attractive because the potential gains are large. In effect, the potential exists to achieve the sortation without doing the work; but if the discount is not offered, none of the benefit will be realized.

Type-3 Worksharing. Type-3 worksharing is where the mailer's decision, whether or not he turns the mail over to a competitor, is influenced by factors other than the size of the discount and his cost of doing the work. The primary example of this situation is one where the mailer is concerned about the level of service received and finds that taking advantage of the worksharing discount leads to better service. The most common service consideration would involve the number of days to delivery, but mailers can also be interested in achieving delivery on a certain date or even in reducing the risk that the piece is lost in the mail.

Two examples of this kind of situation are important. First, a mailer could find that mail presorted and/or barcoded zips through the system without delay while other mail, which needs more postal attention, is either delayed or is unpredictable. In this situation, the value to the mailer of the improved service would be considered along with the cost of doing the work.[8] Second, a mailer considering drop shipping could know that mail entered at a destination facility is always delivered within one or two days while that entered at a distant location takes much longer and is less predictable. This mailer would clearly consider the value of the improved service along with the cost of the drop shipping.

[8] Some mailers have found that turning the mail over to a presort firm, which requires time to do the additional work, results in a 1-day loss in service. In response, some presort firms provide same-day entry and some drop ship to nearby locations.

From a welfare point of view, the situation here also has potential. For example, suppose the discount is 4¢ (per piece) and the mailer's cost of doing the work is 3.8¢. It would seem on first glance that the gain from having the mailer do the work is only 0.2¢. But if the value of the improved service is 1 cent per piece, then the gain from offering the discount is amplified to 1.2¢. If the discount is not offered, the mailer would clearly not do the work or receive the improved service. Important also is that if the improved service is not feasible, the mailer could decide to use an alternative to the postal system. Conversely, the mailer could increase his volume if the discount and the associated service *are* offered.

Type-4 Worksharing. A type-4 discount situation is where the mailer reduces the work required by changing his behavior in efficient ways that were either not predicted or that do not seem particularly associated with the nature of the discount. Two examples are offered: The first involves drop-ship discounts and the second involves the letter/flat differential.

A drop-ship discount can be as simple as a price for nationwide mail and a price for mail entered at the destination office. A mailer in New York could be sending mail to Los Angeles. If mailed from New York, he would pay the nationwide price but if entered in Los Angeles, he would pay the lower destination price. If the difference between these two prices is large enough, the mailer could hire a trucking firm, as discussed above. But there is also the option of having the mail printed by a firm in Los Angeles, which would make destination entry quite natural. Without the drop-ship discount, the mailer will not consider the Los Angeles printer, even if the printing cost is the same as in New York. With the drop-ship discount, the mail might be printed in Los Angeles and the burden of transportation would be avoided entirely.

As a second example, consider the letter/flat differential.[9] Under such a rate structure, letter-size pieces have a lower rate than flat-size pieces. The discount might be justified on the basis of nothing more than an interest in cost-based rates, and worksharing might not be an issue. Some mailers, however, will convert flats into letters. Considering

[9] Some readers may not view a letter/flat rate differential as focused on worksharing. I include it here because it is a discount and it can lead to a reduction in postal work.

the cost of delivery and the benefits received by the mailer, the letter-size piece might be a more efficient piece for the nation as a whole, but the mailer will not make the change unless a rate differential is offered.

Type-5 Worksharing. A type-5 situation is one that has worksharing aspects but which is directed primarily at making the postal system more competitive. The drop-ship discount is, again, an obvious example. Suppose a mailer in Cleveland has mail that is to be delivered in Cleveland. If the postal service presents him with a rate that does not vary with distance, he may, in effect, be subsidizing other mail. For example, if the average piece of mail travels 1,000 miles and that is the cost on which the rate is based, mail going over 1,000 miles gets a relative bargain and mail staying in the office of entry can be viewed as helping to finance the long-distance mail.

Now suppose there is a private delivery firm in Cleveland that is competing with the postal service.[10] That private firm will base its rates on the costs that it incurs, given that it both receives and delivers the mail in Cleveland—it will not charge a 1,000-mile rate. If the postal service charges only a 1,000-mile rate, with no distance differentials and no associated drop-ship discounts, the postal service will be at a disadvantage and may not be competing effectively. It could easily lose business, even if it is the low-cost carrier.

If the postal service offers distance-sensitive rates, it will be more competitive in Cleveland. This is the case whether or not any mailers decide on the basis of the price differentials to engage in drop shipping. In short, the rate structure could be established in order to be competitive or to base the prices on the actual costs of the mail, and worksharing activity could occur as a natural result.

Section Conclusion. Many worksharing discounts evoke responses based on more than one of the situations described above. For example, presort discounts have aspects of type 1, type 2, type 3, and maybe some of type 5. Similarly, drop-ship discounts have multiple aspects. The reason for delineating these various types is to emphasize that if the advocacy of offering the discounts is to be analyzed, all of the dimensions need to be considered.

[10] The Private Express Statutes in the United States do not prevent private firms from delivering parcels, periodicals, catalogs over 24 pages, or saturation mail. These firms, however, may not use the mail boxes.

Part II: A Specific Model

In the Docket No. R97-1 rate case before the Postal Rate Commission, an econometric model became available for First-Class Mail with the characteristic that basic mail and workshared mail are treated separately. The actual model contains a number of variables.[11] For present purposes, however, interest centers only on the price variables and the discount variables. Holding all other variables constant, and integrating their effects into the constant term, the equation for basic mail becomes:

$$V_b = 28.572\ P_b^{-0.189}\ D^{-0.164} \qquad (1)$$

And the equation for workshared mail becomes:

$$V_{ws} = 51.034\ P_{ws}^{-0.289}\ D^{0.227} \qquad (2)$$

Where V = volume in billions of pieces, b = basic (referring to the non-workshared category of First-Class Mail), ws = workshare, P = price, and D = discount. The volume variables are the number of pieces in the category and the price variables are fixed-weight indexes of the range of prices paid by the mailpieces making up the category. In Fiscal Year 1996, the volume of basic (First-Class) mail was 54.1 billion pieces and the volume of workshared (First-Class presorted) mail was 39.1 billion. The workshared mail consists primarily of mail presorted to the 5-digit level, with a small proportion of carrier route presorted mail. Some of this mail is also barcoded. The basic mail consists of all other mail and therefore includes flat-size pieces as well as letter-size pieces, and heavy-weight pieces as well as light-weight pieces. Some basic mail has hand-written addresses but

[11] See the Direct Testimony of Thomas E. Thress on Behalf of the United States Postal Service, USPS-T-7, Docket No. R97-1, U. S. Postal Rate Commission, pp. 40-41. Mr. Thress' complete model includes the price of First-Class cards, the price of Standard A, the workshare discount, three lags on these variables, permanent income, transitory income, user costs, certain dummy variables, and seasonal coefficients.

most is machine addressed. Basic mail also includes some parcels under 11 ounces and some non-standard pieces.

The price index (weighted price) for basic mail in 1996 was 39.2¢ and for workshared mail was 27.6¢.[12] The difference between these two is 11.6¢. This difference, however, reflects much more than just a weighted average of the discounts available to the workshared mail. It also includes rate differences due to weight and to whether the piece is non-standard in shape. The value of D in 1996 was 6.0¢. This is a weighted average of the various discounts available for presorting and barcoding.

Compared to the basic category, the qualitative characteristics of the workshare category are reasonably uniform. In brief, most workshared pieces are probably paying a rate of about 27.6¢. Therefore, the similar pieces which are not workshared, and are not getting the discount of 6.0¢, are paying a price of 6.0¢ + 27.6¢ = 33.6¢. We may think, therefore, of the 39.2¢ price for basic mail as composed of a group of mailers paying 33.6¢ and another group paying, maybe, 45.0¢. The pieces paying 33.6¢ may be viewed as *candidates* to become workshared, if the discount is increased. If the prices of all basic mail were increased, say, 20%, the 33.6¢, the 45.0¢, and the 39.2¢ average would all increase by 20%. At the new price level, the ratio of the price of the candidate mail to the average price of basic mail would remain the same. If this ratio is designated as γ, then:

$$\gamma = \frac{P_{candidate}}{P_b} \qquad \textbf{(3)}$$

and

$$D = \gamma P_b - P_{ws} \qquad \textbf{(4)}$$

[12] The variables in the equations are in dollars and in billions of pieces. For ease of discussion, they will be referenced in the text in cents per piece. Also, gains and losses in welfare, technical efficiency, and profits will be referenced in millions of dollars, although certain graphs may refer to them in billions.

The value of γ in the situation described above is 0.857.

According to the Postal Service's costing systems, the per-piece cost of basic mail in 1996 was 26.1¢ and the per-piece cost of workshared mail was 10.6¢.[13] The difference between these two costs is 15.5¢. These costs are developed primarily to be marginal costs and will be assumed to be marginal costs in this paper. This difference of 15.5¢ is due to a range of characteristics which workshared mail exhibits. For example, basic mail has a higher average weight, with pieces ranging from 1 to 11 ounces, while most workshared mail weighs in the neighborhood of 1 ounce. Also, most workshared pieces are letter-size and many basic pieces are flats, which cost more to process. There are other differences as well. The addresses on workshared pieces are generally thought to be more accurate and are almost always machine readable. Some basic pieces have hand-written addresses, and some basic pieces are parcels.

In order to go much further, we need to know the cost of the pieces that are candidates for moving from the basic category to the workshare category. Since, in substantial degree, the rate setting process in the United States sets discounts equal to associated cost differences, I am assuming for present purposes that the current discount equals the current cost difference between the candidate mail and the workshared mail. Therefore, the cost of the candidate mail becomes 16.6¢ (10.6¢ + 6.0¢). Also, I will be assuming that the 6.0¢ cost of the Postal Service to take the mail from basic to workshared condition is constant as limited quantities of mail move back and forth between basic and workshared. This is a simplification of reality, which probably involves a curve with a slight upward slope. That is, as the discount is increased in steps, the cost to the Postal Service of sorting the mail that becomes workshared on step 4 is probably greater than the cost of sorting the mail that becomes workshared on step 3. This assumption will be relaxed in Part III below, where larger discount changes are considered.

Note that since the discount is equal to the savings experienced at the margin as additional pieces become workshared, the base (1996) position becomes the efficient

component pricing (ECP) position. In postal parlance, we would say that the discount equals 100 percent of the cost avoidance at the margin, or that the passthrough of the avoidance is 100 percent.

Now that we know the prices, the quantities, and the costs, the total revenue is easily calculable as $31.9988 billion, the total marginal cost as $18.2647 billion, and the contribution to fixed costs (or to institutional costs) as $13.7341 billion. The contribution is defined as the difference between total revenue and total marginal cost. If this initial position is assumed to be a breakeven position, then any other breakeven position must have this same contribution.

Note that the demand equations shown above are somewhat different from those normally encountered. As shown in Equation (4), the D term in the V_b equation contains P_b, so when P_b changes, the discount is affected. The exponent of P_b in Equation (1), then, is not a traditional elasticity; rather, it is an elasticity for changes in own-price when the discount remains unchanged, referred to in this paper as a *no-shift* elasticity. In order for the discount to remain unchanged when P_b is changed, the price of the workshare category must be changed in an amount exactly equal to $\gamma\Delta P_b$, as made clear by Equation (4). Note also that Equations (1) and (2) have the characteristic that $\partial V_b/\partial D = -\partial V_{ws}/\partial D$ for each observation point, including 1996.[14]

As a check, I wanted to have a second model available. The models presented above can be converted for this purpose into more traditional models, with ordinary elasticities and cross elasticities, with the same characteristics at the current position. Substituting Equation (4) into Equations (1) and (2) yields:

$$\mathbf{V_b = 28.572\ P_b^{-0.189}\ (\gamma\ P_b - P_{ws})^{-0.164}} \qquad \mathbf{(5)}$$

$$\mathbf{V_{ws} = 51.034\ P_{ws}^{-0.289}\ (\gamma\ P_b - P_{ws})^{0.227}} \qquad \mathbf{(6)}$$

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[13] These are the costs as reported by the Postal Service. During rate cases, the Postal Rate Commission has sometimes made adjustments to Postal Service costing. It is doubtful that using adjusted costs would change the nature of the results obtained.

[14] This characteristic is a symmetry condition imposed in the econometrics as the demand equations were developed.

For the own-price elasticities in a traditional model, we need respectively:

$$e_b = \frac{\partial V_b}{\partial P_b} \frac{P_b}{V_b} \tag{7}$$

$$e_{ws} = \frac{\partial V_{ws}}{\partial P_{ws}} \frac{P_{ws}}{V_{ws}} \tag{8}$$

For the cross elasticities (ce) in a traditional model, we need:

$$ce_b = \frac{\P V_b}{\P P_{ws}} \frac{P_{ws}}{V_b} \tag{9}$$

$$ce_{ws} = \frac{\partial V_{ws}}{\partial P_b} \frac{P_b}{V_{ws}} \tag{10}$$

If the partial derivatives of Equations (5) and (6) are substituted into Equations (7) – (10), we get:

$$e_b = -0.189 + \frac{-0.164 g P_b}{g P_b - P_{ws}} = -1.1074 \tag{11}$$

$$e_{ws} = -0.289 - \frac{0.227 P_{ws}}{g P_b - P_{ws}} = -1.3328 \tag{12}$$

$$ce_b = -\frac{P_{ws}\ (-0.164)}{g\ P_b - P_{ws}} = 0.7544 \tag{13}$$

$$ce_{ws} = \frac{P_b\ 0.227}{g\ P_b - P_{ws}} = 1.2707 \tag{14}$$

Putting these into a traditional model with a constant appropriate to the current position yields:

$$\mathbf{V_b = 50.6501\ P_b^{-1.1074}\ P_{ws}^{0.7554}} \tag{15}$$

$$\mathbf{V_{ws} = 23.1120\ P_{ws}^{-1.3328}\ P_b^{1.2707}} \tag{16}$$

To those who are conditioned to thinking of the demand for First-Class Mail as being rather inelastic, the elasticity, for example, of -1.1074 may seem high. The reason, however, is clear. If the price of basic mail is incresed and the price of workshared mail is held constant, the discount will increase automatically and volume will decline for two reasons: (1) because the price is higher, some customers will reduce usage and (2) because the discount is higher, some customers will decide to workshare and will leave basic.

In Equation (15), an increase in P_{ws} amounts to a decrease in the discount, causing workshared mail to stop worksharing and shift to V_b. There is clearly a symmetry between changing P_{ws} in the V_b equation and changing P_b in the V_{ws} equation. Note, however, that the cross-elasticities stop short of obeying the Slutsky-Schultz condition. This is because of Equation (4), which shows that a change in P_b and a change in P_{ws} do not have the same effect on the discount.

We now have two models that are equivalent at the current position. Equations (1) and (2) are derived from the testimony of witness Thress and will be referred to as the Thress model or the Thress equations. Equations (15) and (16) are the more traditional

constant elasticity equations and will be referred to as the eXe (pronounced e-cross-e) model or the eXe equations. Although built to have the same characteristics at the current operating point, they characterize sightly different behavior as we move away from the current point.

These models represent whatever it is that mailers think about when they decide how much to mail and whether to presort. The mailers know their costs, their options, their preferences, and their other interests, such as service. Note that as the discount increases, more and more mailers workshare. This provides an upward sloping supply of workshared mail. In the basic Thress equation, the discount going from its current level of 6.0¢ up to a level of 7.0¢, with no change in the basic price, causes the basic volume to go from 54.1 billion down to 52.7495 billion. Thus, a 1-cent increase in the discount causes about 2.5% of the basic volume to shift to presort. If anything, at least to the writer, this seems on the small side.

These models have been constructed to represent the system in the neighborhood of the current operating point. They should make good predictions for small or moderate changes about the current point. Without going too far, the directions of change, the general magnitudes of changes, and the patterns representing the rates of change should be meaningful. Two general kinds of changes will be considered in this part of the paper. The first involves holding the price of the basic category constant and changing the discount. The second involves keeping the Postal Service at breakeven while the discount is changed. In both cases, attention will focus on welfare levels and technical efficiency. Part III of the paper will consider changes outside the neighborhood of the current operating point.

When cross elasticities are weak or non-existent, welfare changes can be calculated from areas under simple demand curves. When cross elasticities are strong, however, the demand curves shift. Since the models being used here are characterized by strong cross elasticities, it was necessary to develop a method of dealing with the shifting curves and with mailers that shift toward worksharing when the discounts increase. The writer explored several methods of estimating the effects involved. Several decisions had to be

made about how various adjustments would be handled. In most cases, the results are relatively robust to the decisions made.

The approach taken is based on the assumption that mailer decisions on whether to engage in additional worksharing are based entirely on the absolute level of the discount. Also, the assumption is made that all new worksharing volume comes from basic volume. In support of the latter assumption, it seems reasonable to believe that potential mailers not now sending mail are not likely well situated to find worksharing attractive at somewhat higher discount levels than those at the base position. Another assumption made is that the volume equations are better able to predict market responses when one variable is changed from the base position than when both variables are changed.

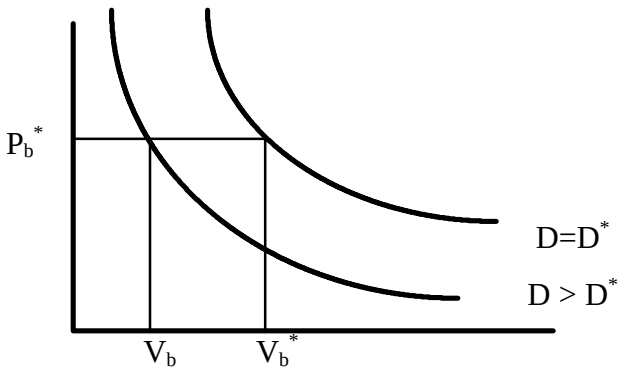
Within the framework of these assumptions, three steps are taken. First, the level of the discount is held constant, so that no mailers will change their decision on whether to workshare, and estimates are made for the basic market. Second, the level of the discount is held constant and similar estimates are made for the workshare market. Third, the discount is allowed to change and estimates are made for the volume that shifts to or from being workshared. Note that it is the volume that shifts that can be processed by a higher or a lower cost provider. Therefore, changes in technical efficiency are based on the shifting volume. Not necessarily in this order, these steps are described in the next two sections.

Behavior of Profits and Welfare with Discount Changes,
Basic Price Held Constant.

If the prices of the basic category were regulated and precluded from going above a certain level, as might occur under a price cap arrangement, but the Postal Service were given the freedom to adjust the discount and therefore the workshare price, a natural question would concern the extent to which the Postal Service's net income (hereinafter often called profits) could be changed by changing the discount, and how this change would compare with the welfare effects on mailers. Also, a question can be asked about

technical efficiency gains and losses as work is shifted to and from the mailers.[15] These questions can be answered with both the Thress model and the eXe model. The discount is changed directly in the former model, and by changing the price of workshared mail in the latter. Because it is easier to think about, the discussion will proceed as though the discount were being *increased*, so that there is more worksharing. All of the equations, of course, apply for both discount increases and decreases. Also, the discussion will focus on the Thress model, with the understanding that similar calculations can be made with the eXe model. To simplify the discussion, we will talk about any worksharing as though the mailer were doing it, even though the mailer might turn the work over to another firm (a firm that might be viewed as competing with the Postal Service for portions of the work) or to a contractor/agent.

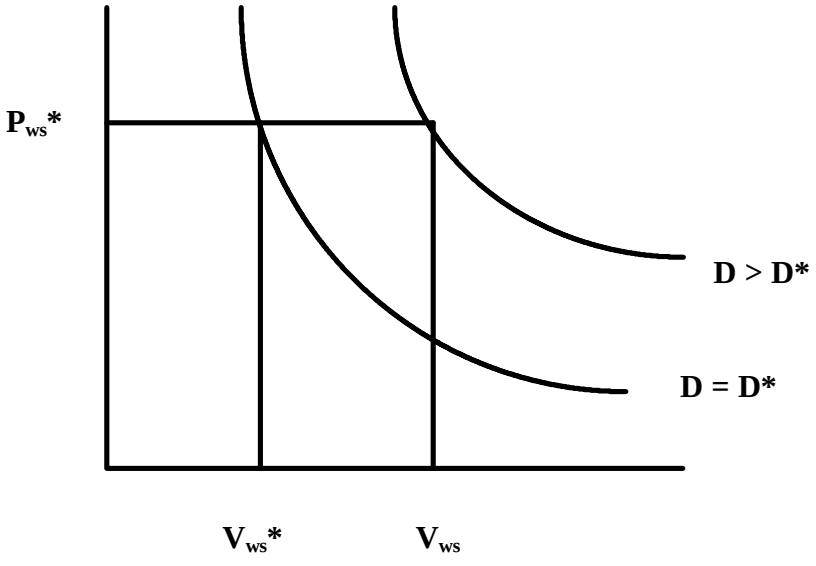
The first step is to select a range of discounts from 1¢ to 11¢. This is a large neighborhood around the current level of 6¢, but weight need not be given to distant results. With this done, the workshare prices (P_{ws}) can be calculated immediately as $\gamma P_b - D$, where P_b remains at the current level of 39.2¢. Next, using Equation (1), the volume that *leaves* the basic category can be calculated as the initial volume (54.1 billion) less the volume calculated at the current P_b and the new discount. Graphically, the leaving shift volume appears as follows:



[15] In this paper, technical efficiency refers to the absolute cost of getting a certain quantity of work done. Getting the work done at a lower cost, regardless of who does the work, is more efficient. Technical efficiency does not related to consumer utility or to consumer welfare.

Values at the base (current) position are indicated by an *. The leaving shift volume equals V_b^* - V_b. A question needs to be answered about whether the above curve is really a demand curve, since customary demand curves hold the prices of substitutes constant and this one holds the discount constant. Fundamentally, a demand curve shows how a market responds, given its preferences, to changes in price, when other factors affecting quantity do not change. I view this demand curve as showing how the market responds, given its preferences, when other factors affecting volume do not change, including that no mailer in the market may consider shifting from basic to workshared. The curve, therefore, is customarily rich in information about the utility the mailers in the market gain (or lose) when the price changes. The constraint relating to shifting will be relaxed in a separate step.

Using workshare Equation (2), a new workshared volume can be calculated using the original workshare price and the new discount.[16] Graphically, the estimation appears as follows:



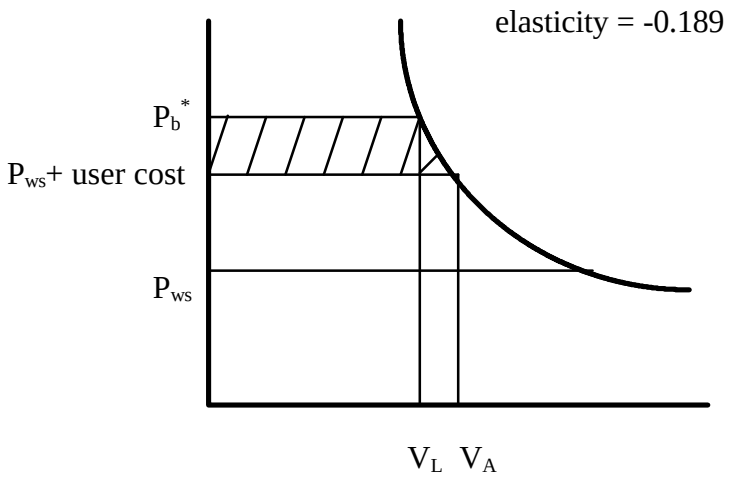
[16] In the new position in this exercise, P_{ws} will be lower and D will be higher. P_{ws} is being held constant at this point in order to focus on the shifting volume.

The difference between V_{ws} and V_{ws}* is one estimate of the *arriving* workshare shift volume, i.e., the volume that decided to workshare under the higher discount, left the basic category, and arrived at the workshare category. This estimate of the arriving workshare shift volume turns out to be larger than the leaving workshare shift volume. Such, of course, would be expected since the shifting mailers are getting a lower price.

The equation for the basic category has prices in it, with the understanding that the mailers look at the prices and decide how much mail to send. As with all demand functions, the mailers are presumed to understand that they must pay any paper, printing, and preparation costs associated with their increased use of the mail. The equation for the workshare category also has prices in it, and may be presumed to model the decisions made by workshare mailers. In addition to the costs incurred by basic mailers, however, these mailers incur what are often referred to as *user costs.* That is, they must incur costs to accomplish the worksharing, however they do it. The mailers who shift from the basic category to the workshare category face an unbalanced situation with respect to user cost. Specifically, they go from a price requiring no user cost to a price with a user cost. Therefore, the gain they experience by shifting is not equal to the price difference; rather, it is equal to the price difference less the user cost they experience. Throughout this paper, I assume that the average user cost for *shifting* mail is equal to the original discount (under which they chose not to workshare) plus ½ of the *increase* in the discount.

Comparing this estimate of the arriving shift volume to the leaving shift volume, and assuming the shifting volume went from the basic price (which does not change in this exercise) to a "price" equal to the sum of the new workshare price and the user cost, I found that the implied elasticity of the growth of the shifting volume was generally in the neighborhood of -2.5 to -4.0. Deciding this was unacceptably large (in absolute value), I chose instead to increase the leaving shift volume with an elasticity of -0.189, which is the elasticity Thress found for the basic category when the discount does not change. One could say that we are *growing* the shift volume as it moves from its old (higher) price position to its new (lower) price position. For each discount level, this provides an alternative estimate of the arriving shift volumes, based on the leaving shift volume and a

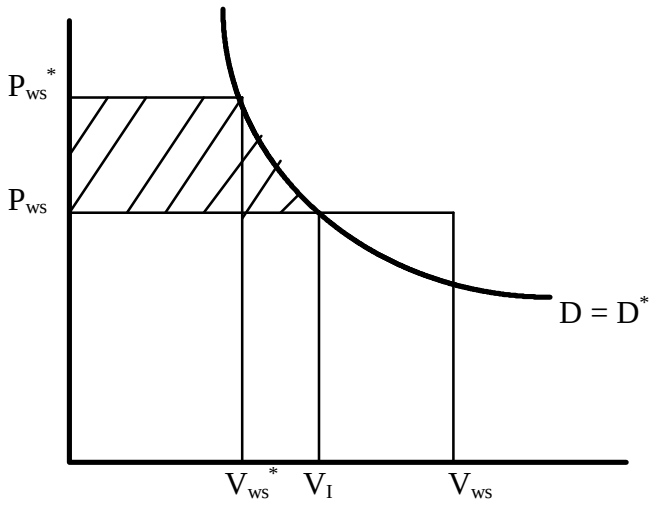
reasonable attendant growth. The situation in which the shifting mailers find themselves can be graphed as follows:



Where V_L equals the leaving shift volume and V_A equals the arriving shift volume. Note that the cross-hatched trapezoid area is the welfare gain of the shifting mailers.[17] Note also that there was no welfare effect on any other basic mailers, because they all remained at the same P_b^*, and then the shift volume was allowed to leave.

The new volume for the workshare category is taken to be the sum of (a) the calculated workshared volume at the new P_{ws} and the original discount, and (b) the arriving shift volume. Graphically, the situation is as follows:

[17] The areas of all trapezoid-like figures in this paper are estimated by assuming that the right-hand sides are straight lines.



Where V_I (intermediate) is the volume of workshared mail that exists at the new workshare price and the original discount, before the shift volume arrives. The difference between V_{ws} and V_I is the arriving shift volume, V_A, discussed above. Note that the cross-hatched trapezoid area is the welfare gain to the workshare market, given the price decrease they experience, before the shift volume arrives.

On the question of how much the leaving shift volume might grow, there is another effect that needs to be mentioned, although it is not dealt with further in this paper. As worksharing discounts are given and competitors begin to compete for business and profits, it is often believed that they might succeed in attracting more overall volume into the system. This is sometimes called a "beat the bushes" effect. Such would, of course, affect both postal service finances and mailer welfare. The basis for believing that volume growth of this kind might occur is not only that there might be more sales people and possibly some product differentiation, but also that these competitors might be able to promote in ways that the postal service itself cannot. In the United States, for example, some competitors are convincing customers that delivery service is good, while the same message coming from a postal account representative might not be as believable. Also, there are sometimes restrictions for policy or appearance reasons on the ways in which government enterprises such as postal services can advertise and promote.

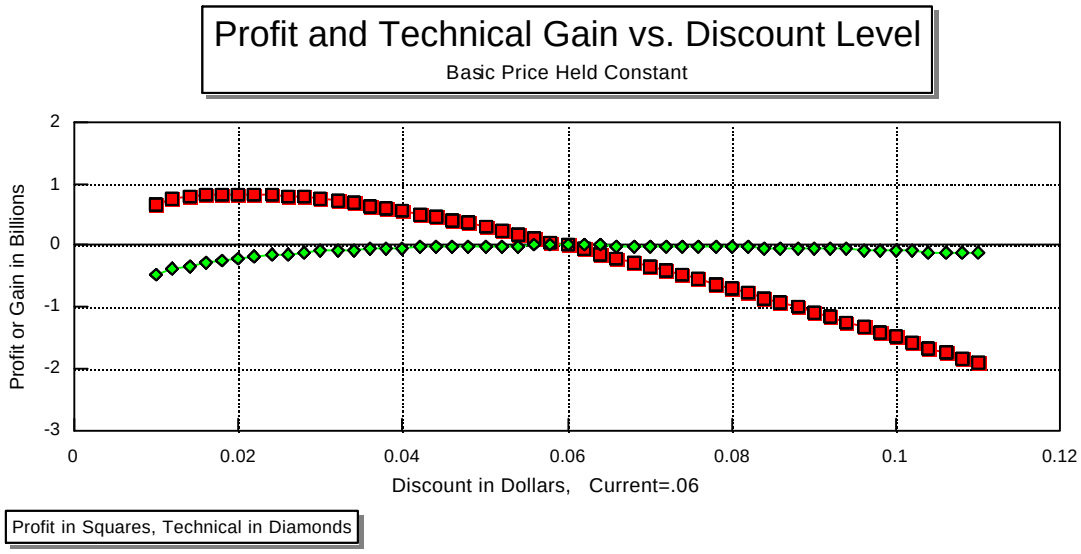
One more adjustment is needed. The shifting volume that leaves the basic category is in the lower price range of all the mail in that category. Therefore, when the

shifting volume leaves, the price index for the basic category increases. Knowing that the price being paid by the shifting volume just before it shifted was equal to γ times the basic price, a revised price index for the basic category can be calculated. This revised price index must be used to calculate the revenue from the basic category after the shift volume leaves.

For each discount, the revenue and the cost at the new position can be calculated. The difference between these two is the gain in profit for the Postal Service. The welfare gain of the mailers is the sum of the welfare gain of the shifting volume and the gain of the workshare market before the shift volume arrives. Both of these areas are cross-hatched above. The technical gain (or loss if negative) for the new position can be calculated as the *leaving* shift volume times the difference between the postal cost of doing the work and the mailers' user cost of doing the work. Given our assumption that the Postal Service's cost for doing the work is 6¢, and knowing that the user cost is above 6¢ for all discount increases, we can expect the gain to be negative for all discount increases. If the discount decreases from 6¢, mail which mailers have been sorting for less than 6¢ will shift to the Postal Service, and the technical gain will again be negative. These signs on the technical gain would be expected for movements from an ECP position.

The two graphs on the next page show the profit results. The top graph is for the Thress model and the bottom one is for the eXe model. Several observations may be made. Given a decrease in the discount, with the basic price held constant, the Postal Service profit increases in both models and appears in the Thress model to reach a peak at a discount of about 2¢. Since 2¢ is rather distant from 6¢, however, this result may not be reliable. At a discount of 4¢, the Thress model shows a profit increase of $563 million and the eXe model shows $581 million. In these same two cases, respectively, the technical loss from having the higher-cost person do the work is $37 million and $29 million. The technical losses, experienced in some sense by all mailers, are clearly small

Thress Model



eXe Model

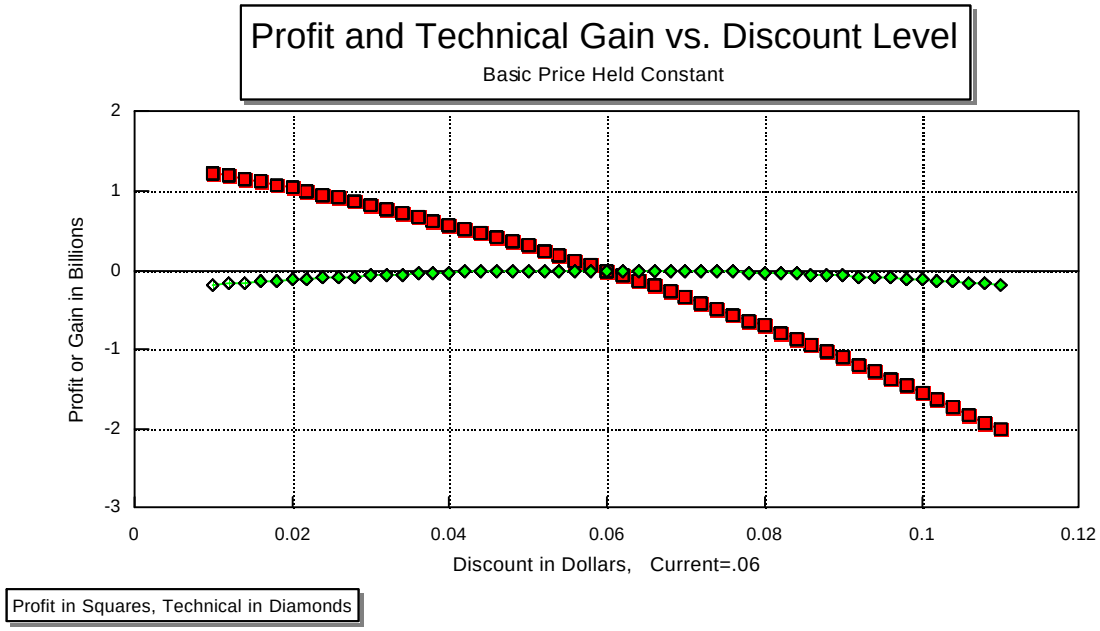


FIGURE 1

relative to the increase in profit. Note also that the slopes of both graphs decrease in absolute value as the discount decreases.

Several ceteris-paribus (one-at-a-time) changes were then investigated. First, the Postal Service's cost of processing workshared mail was changed from 16.6¢ to 14.6¢.[18] Second, the own-price elasticities in the *worksharing* equations were made equal to the corresponding elasticities in the *basic* equations. This removed the finding that the no-shift elasticity of the workshared mail is greater than that of basic mail. Third, the discount elasticity in the Thress model was doubled. When any of these changes are made, the corresponding elasticities for the eXe model must be found using Equations (11) through (14). Fourth, the discount elasticity was set equal to zero, with corresponding zeros in the eXe model. The findings are summarized in the following table.

Description (D=4¢ instead of 6¢)	Profit Gain (Thress & eXe)	Tech. Gain (Thress & eXe)
As shown in Figure 1	563 M and 581 M	-37.2 M and -29.3 M
Postal service cost=14.6¢	637 M and 640 M	37.2 M and 29.3 M
WS e = Basic e (no-shift)	665 M and 697 M	-37.2 M and -29.0 M
2X discount e & cross e	488 M and 526 M	-77.0 M and -60.0 M
Discount & cross e =0	633 M and 633 M	Zero in both cases

Table 1

At the current position, which involves a fixed basic price and a worksharing discount of 6¢, the following observations may be made, using figures from the Thress equations.

1. Assuming the Postal Service cost of doing the workshare work is 6¢, a reduction of 2¢ in the worksharing discount will cause a profit increase of about $563 million. Due to

[18] The implication of this 2¢ reduction in the cost of processing workshared mail is that the postal service can sort the mail for 4¢ instead of 6¢.

work being done by a less efficient provider, there would be an associated technical loss of about $37 million, which is relatively small.

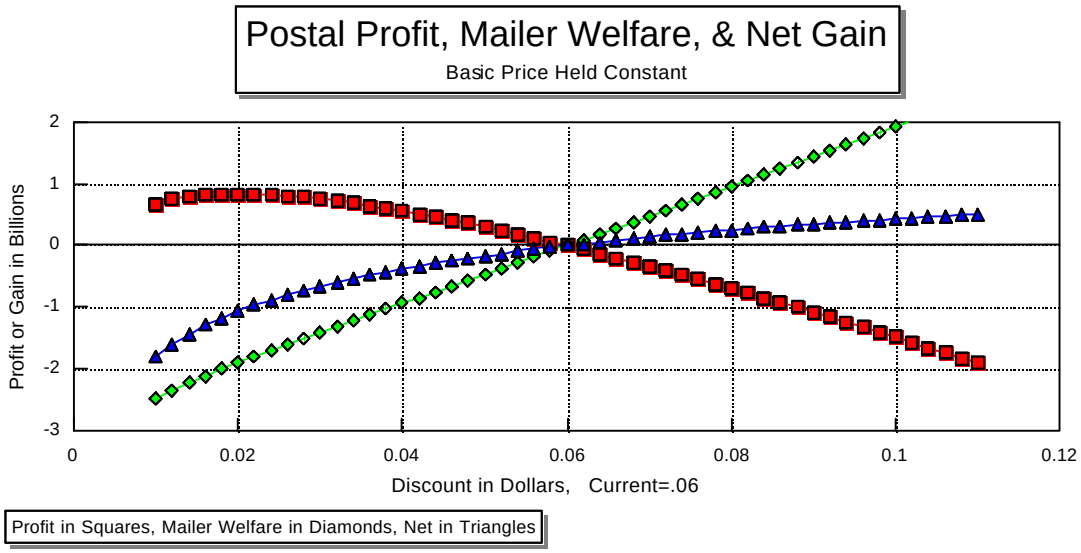
2. Under the same conditions, if the Postal Service cost of doing the workshare work is actually 4¢ instead of 6¢, the profit gain from reducing the worksharing discount by 2¢ would be notably greater at $637 million, and there would be a technical *gain* of $37 million.

3. For discount decreases, the profits of the Postal Service increase much more rapidly if the discount elasticities (and associated cross elasticities) are low rather than high.

4. The profit incentive for the Postal Service to decrease the discount is less when the no-shift own-price elasticity of the workshare category is greater than that of the basic category.

The next two graphs, constituting Figure 2, show Postal Service profits and mailer welfare gains, as well as the sum of the two. The two models provide results that are similar in magnitude. The curvatures are also similar, with small differences at points quite distant from the current discount of 6¢. The losses in mailer welfare, which are of course opposite in sign from the profits, are substantially larger in magnitude than the profits. At a discount of 4¢ instead of 6¢ in the Thress model, the Postal Service gain in profit is $562 million and the loss in mailer welfare is $945 million. The lines made up of triangles show the net loss or gain of the other two curves.

Thress Model



eXe Model

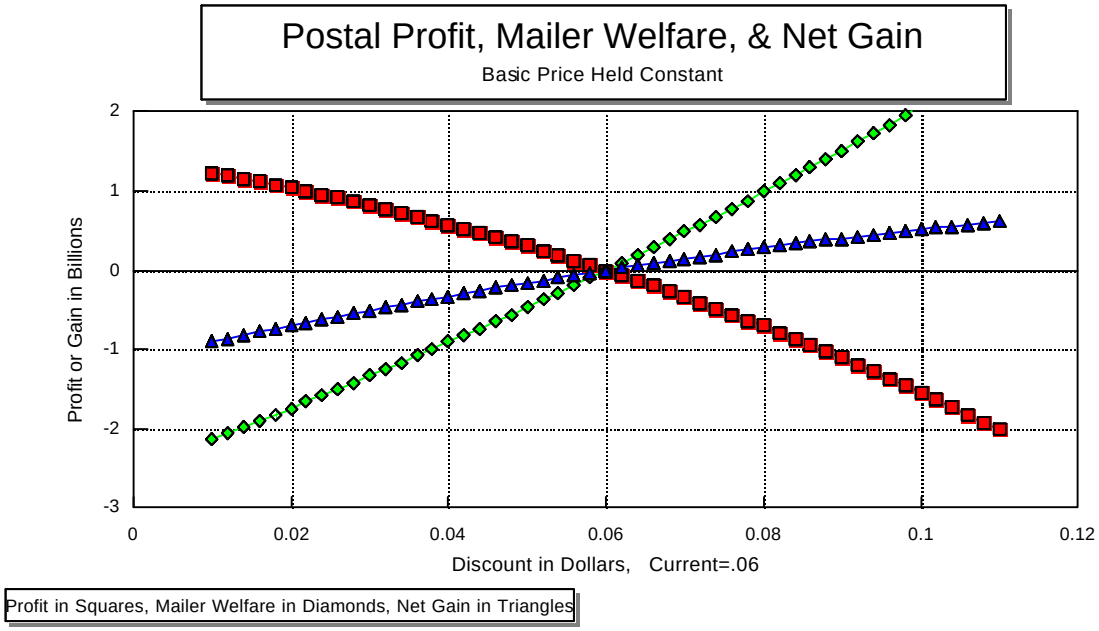


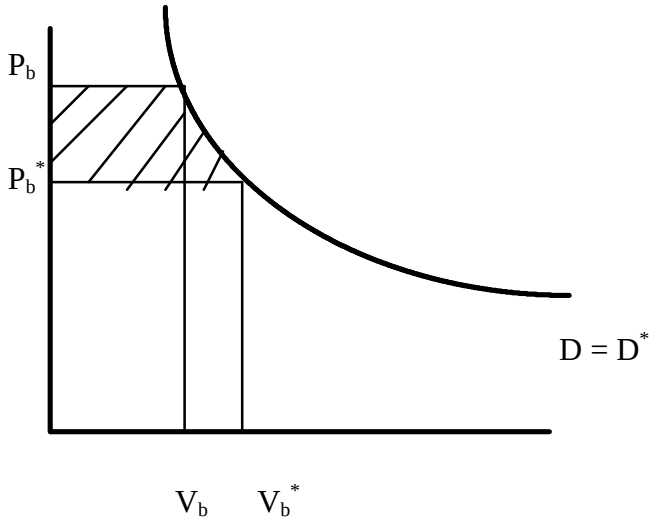
FIGURE 2

Behavior of Welfare Levels with Discount Changes, Under Breakeven

The next step is to relax the constraint that the basic price is fixed and to allow discount changes with the requirement that the Postal Service remain at breakeven. Due to insoluble algebra, a simultaneous solution is not possible. Short of that, the preference would be to select D, express P_b in terms of D and P_{ws} , and then express P_{ws} in terms of the desired net revenue (taken to be the same as the net revenue at the base position—hence breakeven). This, however, is circular and, although convergence was sometimes obtained after a number of iterations, the procedure was found, for the most part, to be unworkable and sometimes unstable.

In the alternative, the procedure adopted was to select D, express P_b in terms of D and P_{ws}, and to use the backsolver routine provided in Lotus 1-2-3 to hunt for the value of P_{ws} that yields breakeven. Within this approach, a number of steps were needed, as will be explained.

Given the new discount selected, the leaving shift volume can be calculated in the same way as in the above example on profits. The next step is to recognize that since P_b will be changing in this case, to allow breakeven, there *will* be a change in welfare in the basic market. The following graph shows the basic market, before the shift volume is allowed to leave.



This is a demand curve, conditional on the constraint that the discount remains the same, under which condition no mailers will shift to workshared. The crosshatched trapezoid is the welfare loss to these mailers as a market, given that they cannot shift.

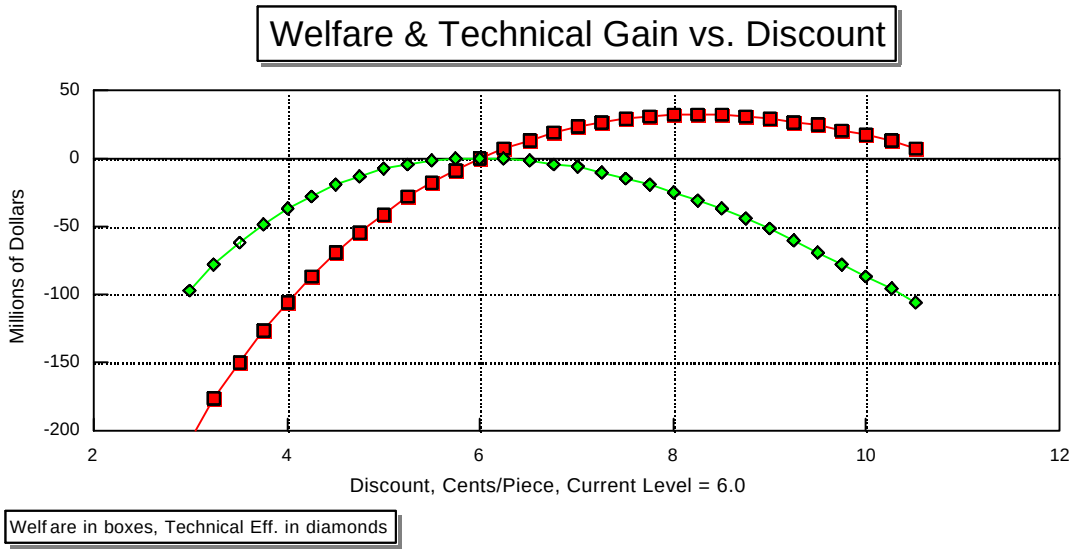
The welfare effects on the mailers who shift are calculated in the same way as in the above section on profits. The shift volume is allowed to grow according to an own-price elasticity of -0.189 and the user costs are estimated in the same way. Also, the welfare effects in the workshare market are calculated in the same way as before.

For discount increases (and conversely for discount decreases), the net welfare is the sum of: (a) the reduction in welfare of the basic market, before the shift volume leaves, (b) the increase in welfare of the shifting volume, and (c) the increase in welfare of the workshare market, before the shift volume arrives. The technical cost effects, due to the work being done by a party that may do it at a higher cost, are also calculated in the same way as before. That is, the leaving shift volume, before it grows, is multiplied by the difference in the cost of doing the work.

Figure 3 shows the basic results for the two models. The lines composed of boxes show the welfare level of all mailers combined and the lines composed of diamonds show the technical losses (if negative) of shifting the work to another party. Figure 4 shows the supply curve of workshare services. In traditional form, it has the discount on the vertical axis.

In the United States, considerable attention is given to setting the worksharing discounts. Two approaches are often discussed. The first is the subclass approach and the second is the rate category approach. In the *subclass approach*, the basic and the workshare category are each given a percentage markup over cost, in order to obtain their average rate. As a simple example, suppose the cost of worksharing is 10¢ and the cost of basic mail is 16¢. If each is given a 50% markup, the average rate levels will be 15¢ and 24¢, respectively. In this case, the rate difference is 9¢, which is equal to the cost difference of 6¢ inflated by the 50% markup.

Thress Model



eXe Model

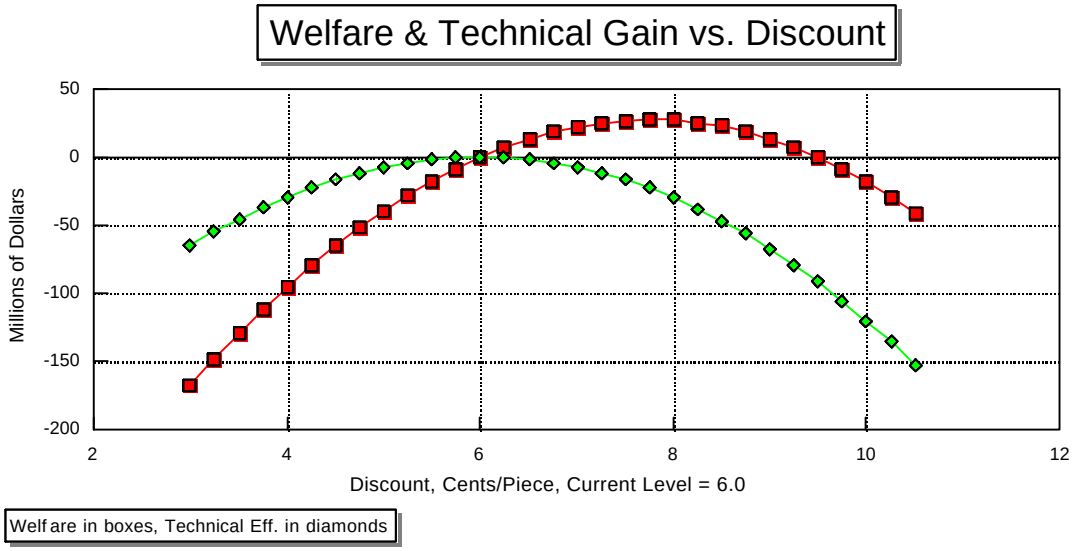
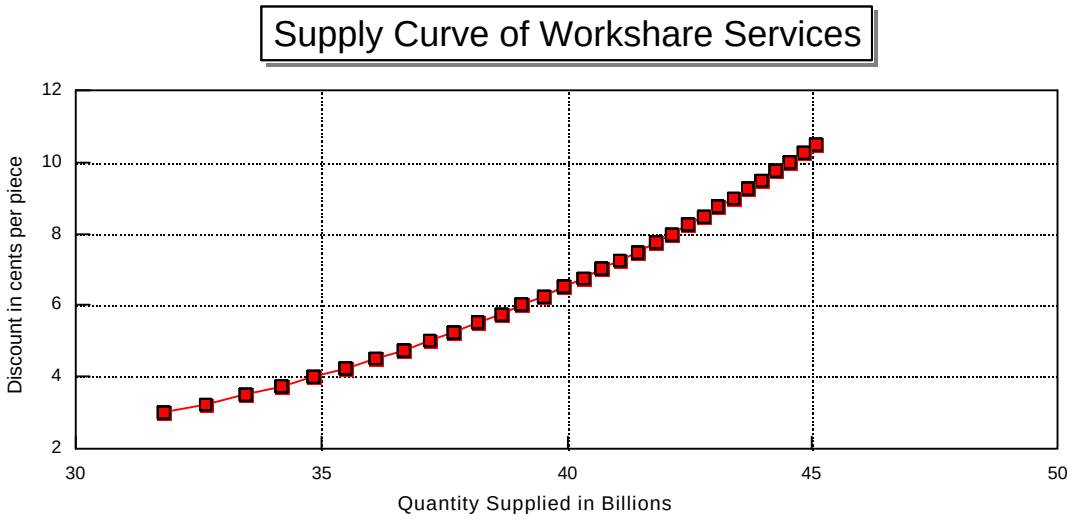


FIGURE 3

Change in Discount, Breakeven Maintained

Thress Model



eXe Model

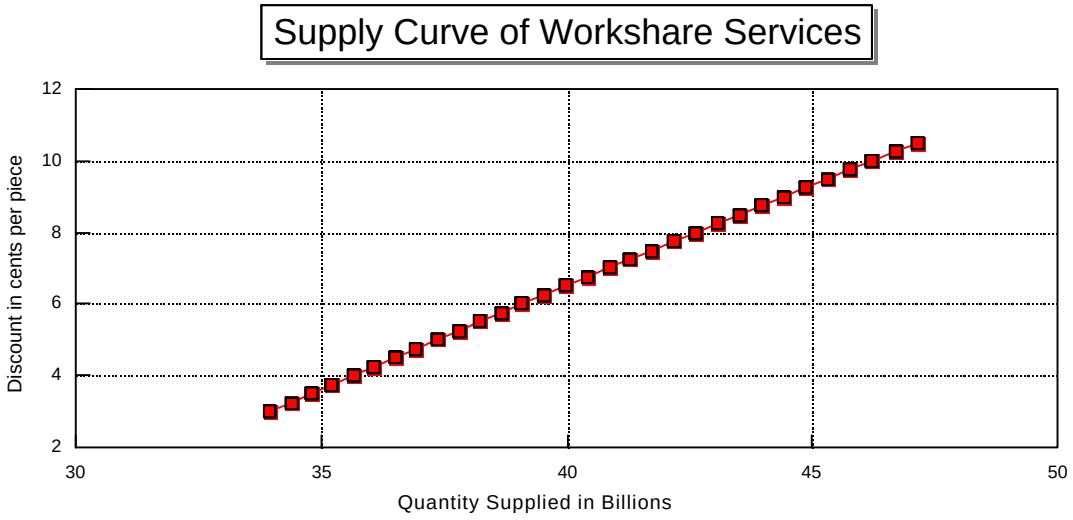


FIGURE 4

In the *rate category* approach, the difference in the rates for the two categories is based on the cost difference. Assuming 100% *passthrough* of the cost difference, which is 6¢ in this example, the rate difference would be 6¢. Handled in this way, the rates might turn out to be 17¢ and 23¢. As discussions concerning rate setting occur, considerable attention is given to selecting the passthrough. The (adjustable) assumption of this paper is that the Postal Service's cost for doing the workshare work is 6¢ and that 100% of this 6¢ is passed through into rates. If the passthrough were over 100%, a result for which some parties argue, the discount would be larger and we would say that we are moving from rate category treatment toward subclass treatment. If the two subclasses were given different proportionate markups, rather than the 50% markups in the example just completed, the comparisons would not be so simple.

In Figure 3, it is clear that as the discount level is increased, implying a passthrough of over 100%, the general welfare level increases, but at a declining rate. The curves of both models appear to reach a maximum at a discount of about 8¢. At the 8¢ level, the Thress model shows a welfare gain of $32 million and the eXe model of $27 million. At the same time, they show technical losses, respectively, of $25 million and $29 million.

It is interesting to look at the makeup of these welfare gains. In the Thress model, at the discount level of 8¢ and the net gain of $32 million, the basic market incurs a welfare loss of $480 million (0.89¢ per piece), the workshare market realizes a gain of $487 million (1.23¢ per piece), and the mailers who shift gain $25 million (1.0¢ per piece). The volume of mail shifting is 2.493 billion leaving basic and 2.507 arriving at the workshare category. This is about 4.6% of the basic volume. At the 8¢ discount level, the overall volume in the system, basic plus workshared, increases 0.69%.

Peter Bernstein, testifying for the United States Postal Service in Docket No. R97-1, prepared estimates of welfare gains under more efficient worksharing discounts.[19] His analysis left some questions unanswered but pointed to efficient discounts well above the 8¢ level and to gains on the order of several hundred million dollars. Compared to his

[19] Directt Testimony of Peter Bernstein on Behalf of United States Postal Service, USPS-T-1, Docket No. R97-1, Postal Rate Commission, p. 93.

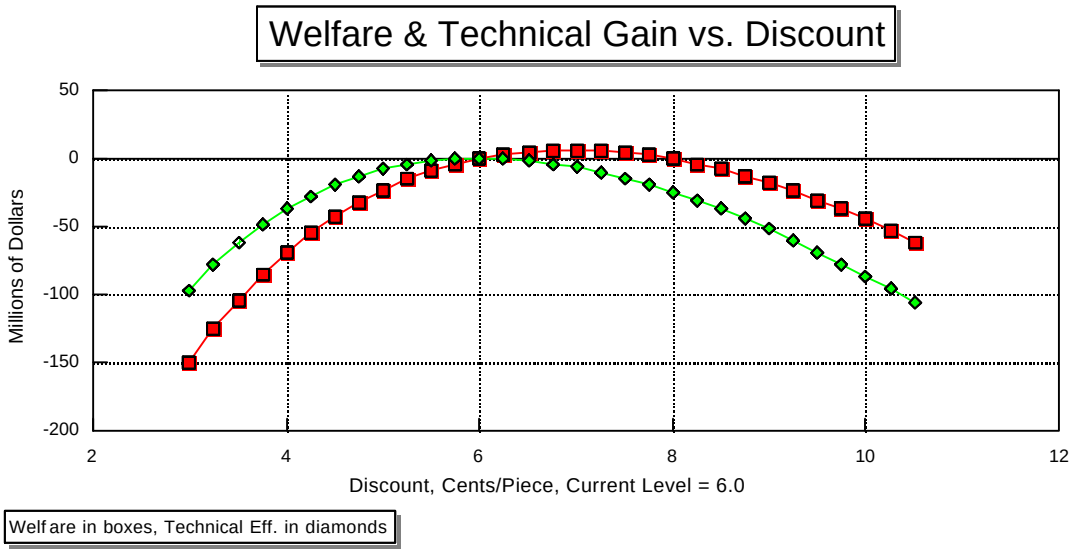
estimates, the 8¢ level seems small, as does the gain of $32 million. In fact, the gain of $32 million is small by almost any standard. Furthermore, achieving it places a burden on basic mailers of $480 million, which is notably large by almost any standard. In terms of Pareto optimality, it appears that a change from the current position imposes large losses on some mailers, large gains on others, and relatively small net gains.

The supply curves of workshare services, shown in Figure 4, are less informative. Assuming they are valid around the current discount level of 6¢, they clearly show a good deal of sensitivity to the discount. At low discounts, however, they still show more volume than might be expected; and at high discount levels, they show supply levels which are not as large as might be expected.

A matter of considerable discussion in the United States concerns whether the (no-shift) own-price elasticity of workshared volume is greater than that of basic volume, as these two categories are now constituted. The Thress model suggests that if the discount remains unchanged, and thus that shifting is not allowed, the elasticity of basic volume is negative 0.189 and of workshared volume is negative 0.289. Prior to Thress' work, information of this kind was not available. A natural question becomes: how sensitive are the results to differences in the two elasticities? Figure 5 shows the basic curves for a situation where both no-shift elasticities are the same at -0.189. It is clear that the efficient discount moves closer to the cost figure of 6¢ and that the welfare gains become much smaller. Specifically, in the Thress model, the peak occurs at a discount of 7¢ and the welfare gain is only $6 million. The conclusion, then, is influenced strongly by whether the workshare category is more elastic.

The discussion surrounding rate category versus subclass status often focuses on the strength of the cross elasticities. In order to shed some light on this question, three special runs on cross elasticities were done. Figure 6 shows the curves for a situation where the discount and cross elasticities are zero, Figure 7 for when the discount elasticities are doubled, and Figure 8 for when the discount elasticities are doubled and the two no-shift elasticities are equal to -0.189. Note that some of the scales on the vertical axes are different on these plots.

Thress Model



eXe Model

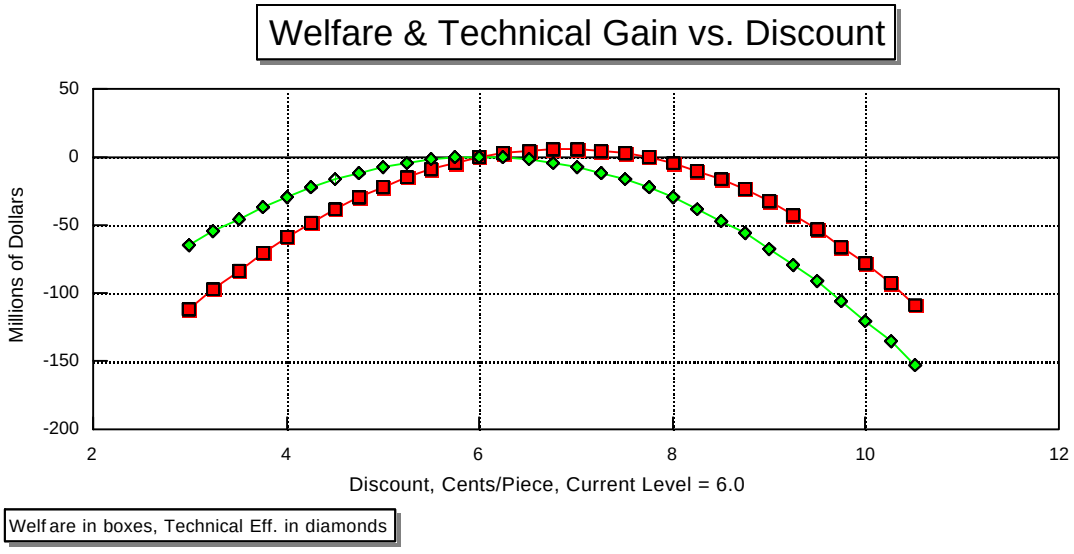


FIGURE 5

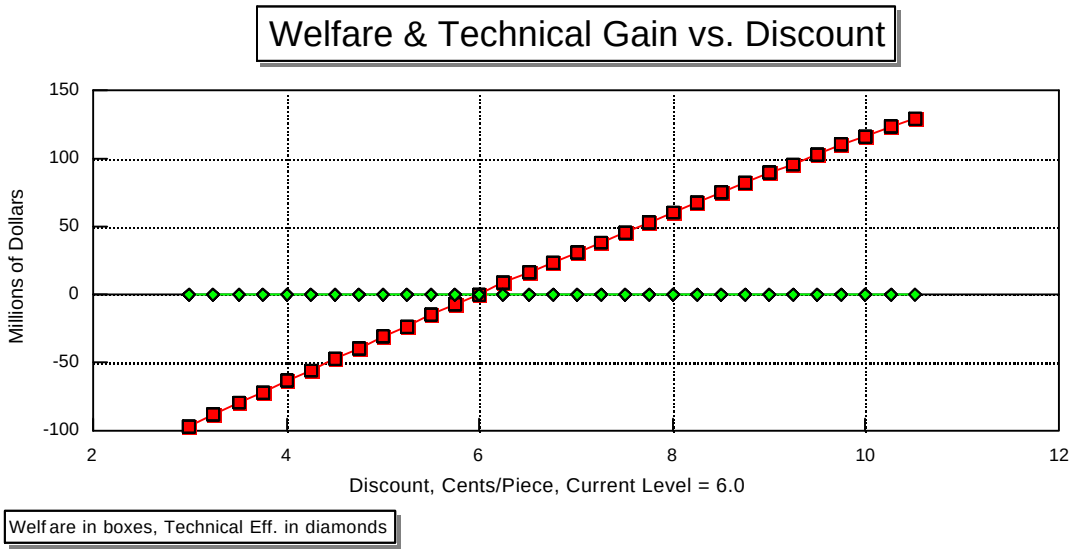
No-Shift Easticities of Basic and Workshare equal at -0.189

The pattern shown by these graphs is clear. When the cross elasticities are zero, substantial welfare gains are available from discounts larger than 6¢ and the optimal discount appears to be well above 8¢. As the cross elasticities become larger, the efficient discount levels move closer to the ECP level and the associated welfare gains available become quite small.[20] And, when the no-shift elasticities of the basic and workshared product are the same, the gains become even smaller and the peak becomes very pronounced.

These models are good only for small to moderate movements from the current position. For larger movements, a somewhat different approach is taken, beginning in the next section.

[20] Recall that under the assumptions made in this paper, setting the discount at 6 cents is the ECP position, where 6 cents is the cost savings at the margin.

Thress Model



eXe Model

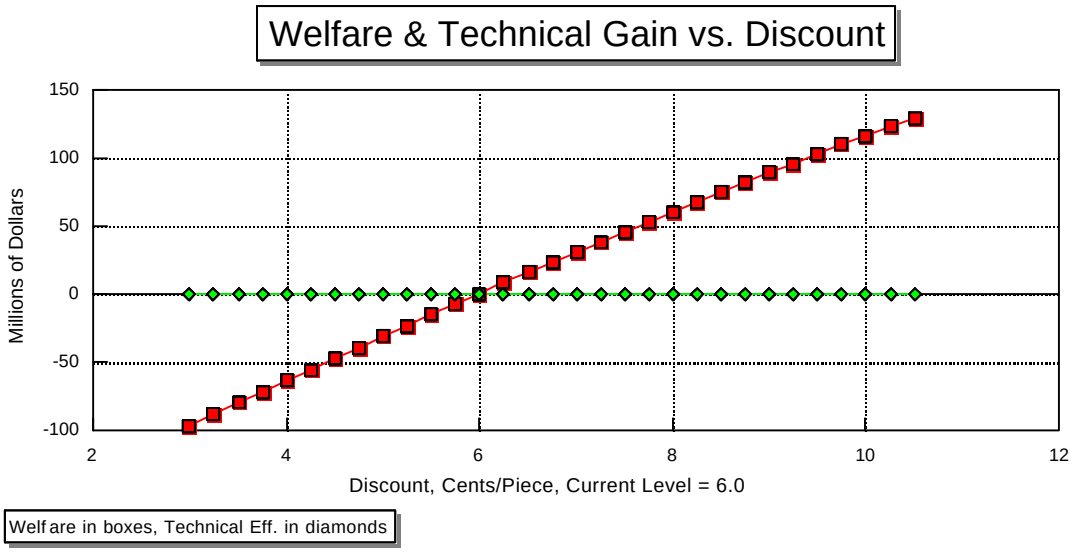
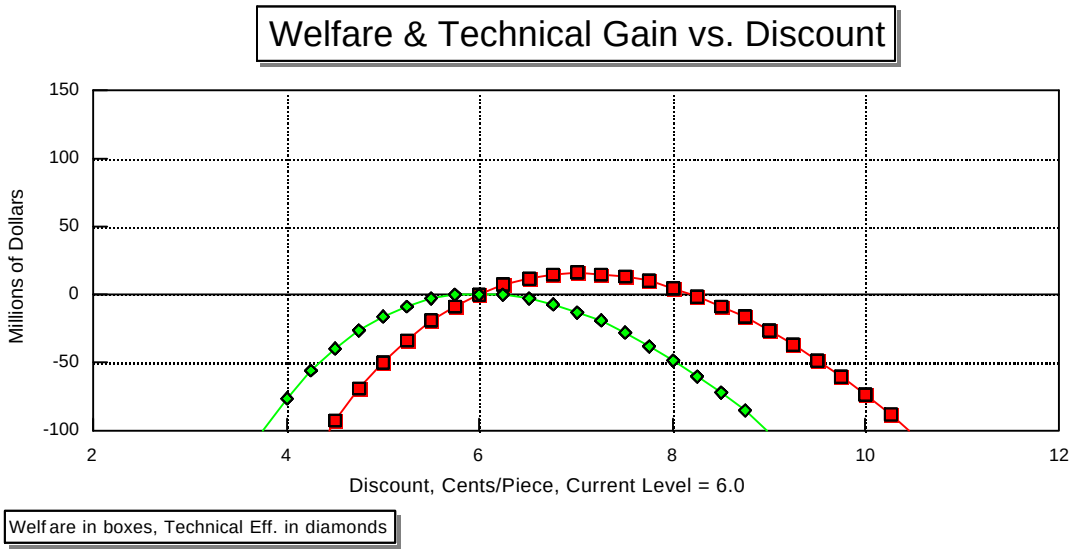


FIGURE 6

Discount and Cross Elasticities are Zero

Thress Model



eXe Model

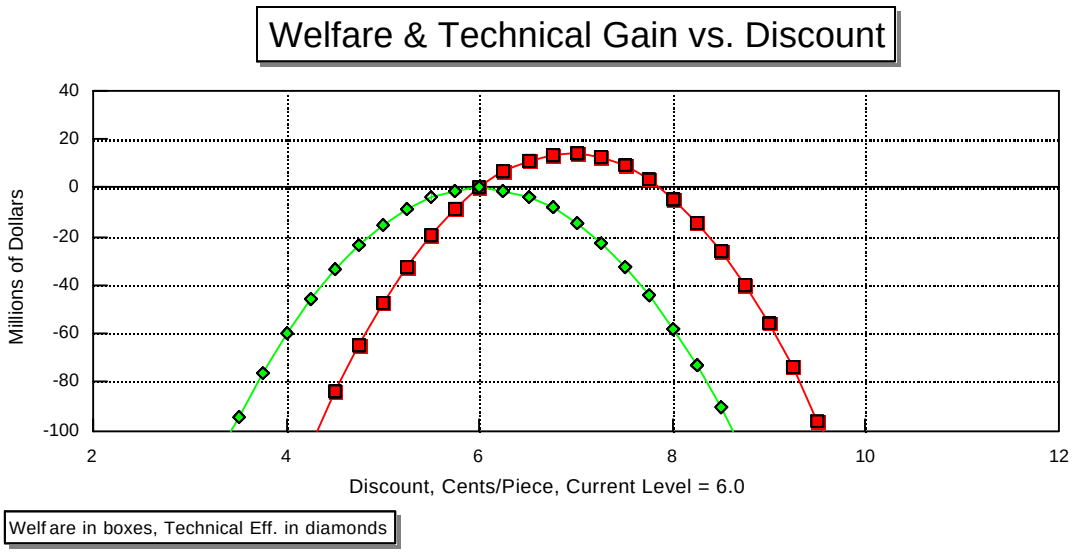
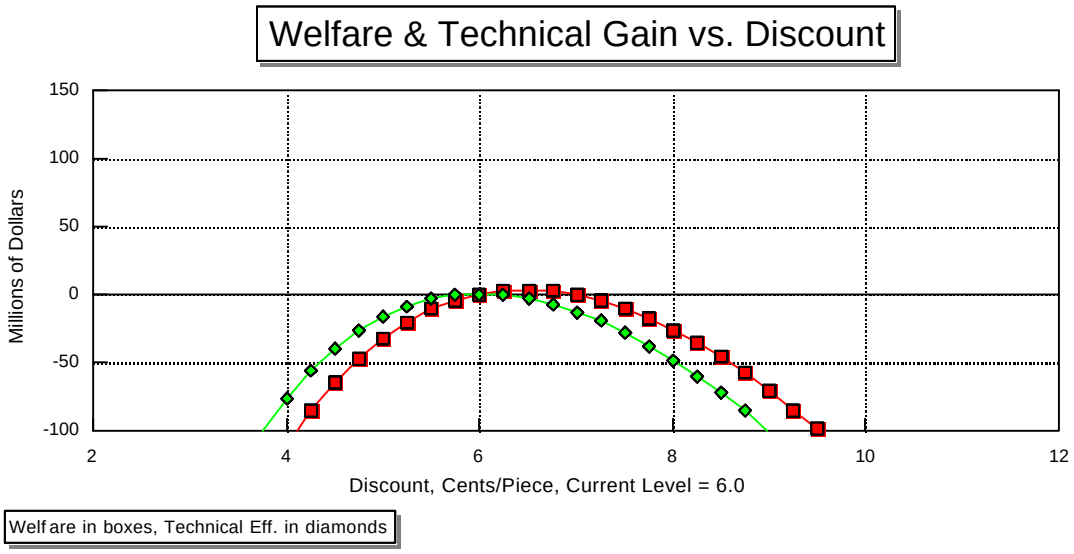


FIGURE 7

Discount Elasticity is Doubled

Thress Model



eXe Model

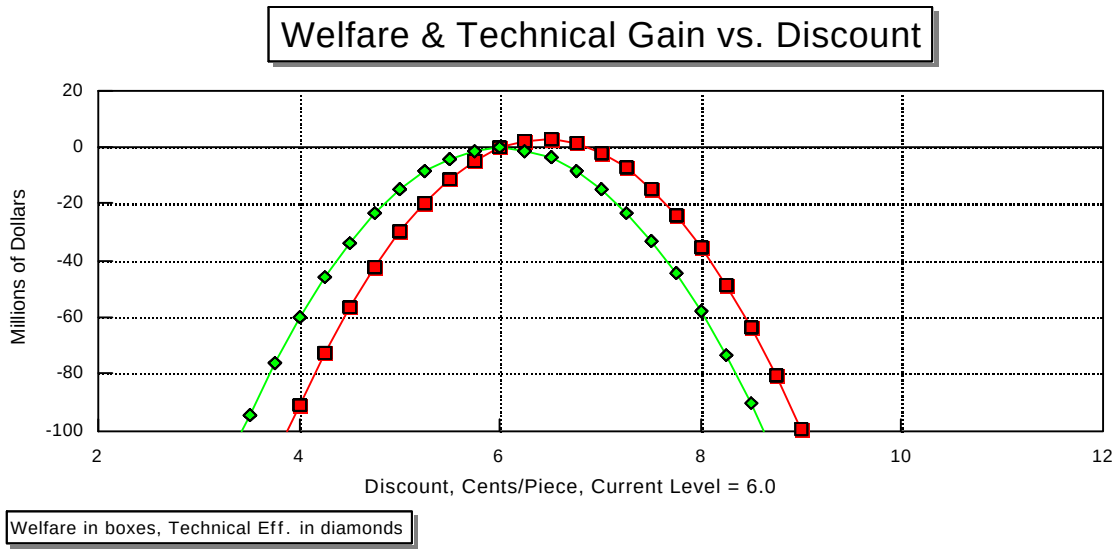


FIGURE 8

Discount Elasticities are Doubled and No-Shift Easticities are Equal

Part III: Some Broader Questions

The advocacy of a worksharing program may be viewed in broader perspective from a base equilibrium position of no worksharing program being offered. Then the question becomes: what would happen if the basic price were held constant and a worksharing program were begun? The previous section asked only about making changes to an existing program, and a well developed one at that.

If no worksharing discounts were being offered, it is possible that some mailers would still workshare. They could feel that the cost of the worksharing is small and that they receive an improvement in service. This could happen in presorting. Another possibility is that they are worksharing without doing anything extra, such as in achieving drop shipment because they are already located at the destination.

Consider a program of discounts for presortation. Initially, as a conservative starting point, suppose the postal service is at breakeven with no discounts and no presort volume. Since many mailers have computerized mailing systems in place and have sufficient volume, they can do presorting work at a very low cost. Without hard evidence, the author believes that a presort discount of ¾ of a cent might induce as many as 20 billion presorted pieces. This is shown in the supply curve in Figure 9.

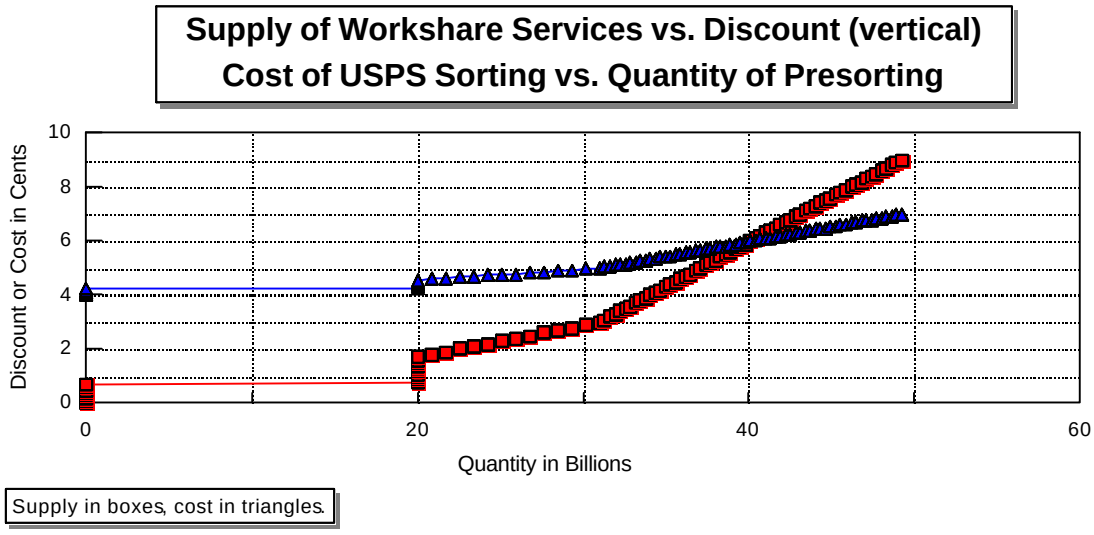


FIGURE 9

Beyond ¾ of a cent, one would expect smaller mailers to begin presorting or that some presort firms would begin to take the mail of highest quality and presort it with optical character readers, probably putting on a barcode at the same time. Suggestions have been offered in the United States that the most attractive customers of some presort firms are being charged a price in the neighborhood of one cent per piece. The graph shows supply increasing up to 30 billion pieces at a discount of 3¢. Beyond 3¢, less attractive customers and relatively more difficult mail would begin to convert to presort. In the neighborhood of 6¢, the curve must align with the supply curve found in the previous part of this paper. The curve shown above is selected to align (roughly) with this requirement.

As the discount increases above 6¢, it is clear from Figure 4 that the curve will continue to rise. At some point, however, it is possible that private industry would rise to the occasion and collect virtually *all* of the mail, process it, and give it to the postal service for delivery. The curve, then, would turn nearly horizontal and the postal industry, short of delivery, would be essentially privatized. These are interesting possibilities.

The other curve shown above, in triangles, is a curve of the cost to the postal service of sorting the mail that begins to presort. What is shown is that the postal service would spend approximately 4¢ per piece to sort and barcode the first 20 billion pieces. The postal service does not have the option of sorting the mail on a computer before the address is printed. It must read the mail, look up the ZIP Code for the address, spray on the barcode, and proceed to do the sorting, probably to the five digit level. The way to think of the above curves is to begin with a discount, go over to the supply curve to get a volume, and then go up to the postal service cost curve to see how much the postal service saved on the last few pieces that converted to presort. Above the first 20 billion pieces, less attractive mail begins to presort and the postal service's costs at the margin undoubtedly begin to increase. They are shown increasing to 5¢ at a presort volume of 30 billion and then increasing more slowly. At a presort volume of 40 billion pieces, the postal service's cost curve goes through the current operating point discussed in the previous part of this paper.

No evidence is available about the slope of the postal service's cost curve at or above the 40-billion-piece level. For purposes of small changes, it was assumed to be horizontal in the previous part of this paper. Almost undoubtedly, however, it has some positive slope. One reason for it to have a very *low* slope is the advent in the United States of what is called Remote Video Encoding. The mail, which can be anywhere from mildly unattractive to rather difficult is put through a sorting machine and a picture of it is taken. The picture appears on a computer screen and an operator reads it and supplies the address to the computer. The computer supplies the ZIP Code and the appropriate barcode is sprayed on the piece. The piece is handled very efficiently from there on. The cost of this Video operation may function as an upper limit for most of the mail. If this is the case, the cost curve would turn almost horizontal at the cost for this operation.

If the above supply and cost curves are accepted, what are the implications? One can easily increase the discount from zero and, for each discount level, calculate several figures: (1) the total revenue lost by the postal service, which is simply equal to the discount level multiplied by the presort volume; (2) the total cost incurred by mailers or by mailing organizations, which is the area under the supply curve; and (3) the total savings of the postal service because it does not have to do the sorting and processing, which is the area under the cost curve. The difference between No. 3 and No. 1 is the increase in the profit (net income) of the postal service. The difference between No. 3 and No. 2 is the technical gain from have a lower cost provider do the work.

Figure 10 shows the results. The line composed of boxes shows the profit position of the postal service. As the discount level (on the horizontal axis) gets up to ¾ of a cent, 20 billion pieces become presorted. The postal revenue decreases by ¾ of a cent times the 20 billion pieces, but the postal cost decreases by 4¢ time the 20 billion pieces. Therefore, the profit position of the postal service increases to the tune of about $650 million and the technical gain to the Nation goes up to the same $650 million. Since the basic price (for non-presorted mail) has not increased, no one has been made worse off. Increasing the discount from zero to ¾ cent, then, was a Pareto optimal move. The postal service is better off, no mailers are worse off, and the excess money can be used to lower prices for all mailers.

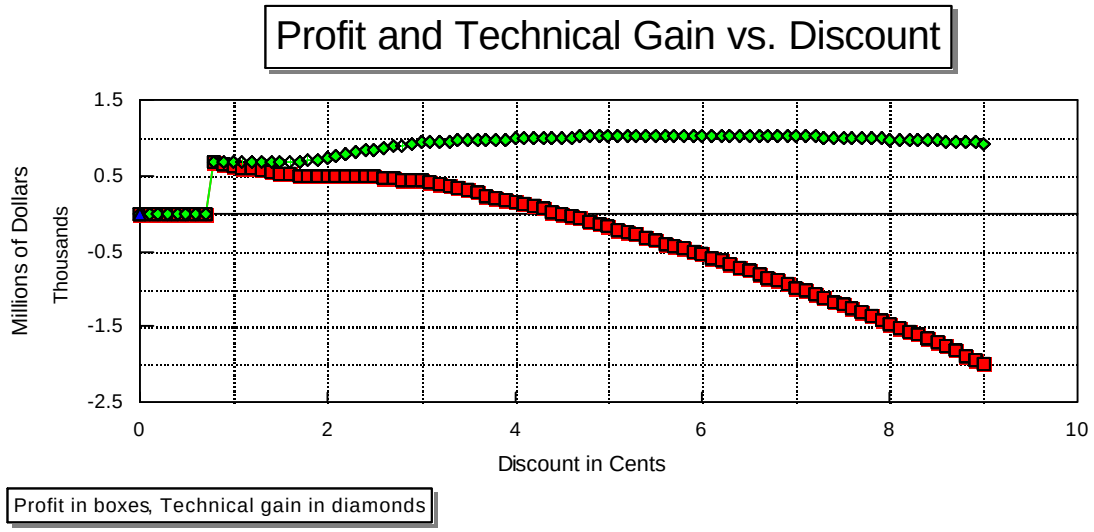


FIGURE 10

As the discount is increased beyond ¾ of a cent, the postal service's profit level declines, but it is still positive. The losses from giving the higher discount to all of the mailers that are already presorting are large and the savings from the additional presorting are small. According to the graph, the postal service's profit level declines until it is back at breakeven at discount of about 4.5¢. Additional work, however, has been transferred to a lower cost provider, causing a technical gain of about one billion dollars. This is a substantial gain from offering a presort program, and it accrues entirely to the mailers. Again, the move from offering no discount to offering a discount of 4.5¢ is a Pareto optimal move—no one is worse off and someone is substantially better off.

As the discount increases above 4.5¢, the postal service falls below breakeven and will have to make up the losses with a price increase for all mailers, both those who are now presorting and those who have not thus far been affected. A move from offering no presort program to offering a discount greater than 4.5¢, then, is not Pareto optimal. Note, however, that up to a discount of 6¢, by the assumption made in this paper, work continues to be shifted to a lower cost provider, but the total technical gains beyond a discount of 2 or 3 cents are very small. This is because we are in a range where the cost to mailers (or their agents) is approximately equal to that of the postal service. As shown

in the previous part of this paper, however, the general net *welfare* level of the Nation continues to increase to some discount above 6¢. What is happening to bring about this net increase is that some mailers are being made better off and some are being made worse off.

Further empirical work along these lines might be difficult. Data such as those in Figure 9 are not readily available and would be difficult to develop. It seems clear, however, that substantial gains are available from presort programs and, by extension, from other worksharing programs, to a point. Beyond that point, many considerations need to be balanced in order to decide on the appropriate discount levels.

Various statements of the ECP rule can now be reviewed. The first statement suggests that the rate difference be set equal to the simple cost difference. In the model discussed in Part II above, the cost of basic mail is 26.1¢ and of workshared mail is 10.6¢. The difference of 15.5¢ is clearly due to much more than worksharing and is much larger than any savings. A discount of 15.5¢ would not make sense. The second statement is that the rate difference should be equal to the average incremental savings for the worksharing program. This would lead to the discount of 4.5¢, which is where the lines cross in Figure 9. The third statement is that the workshare price should equal the marginal cost of the workshared product plus the unit opportunity cost of the program. The size of this figure would depend on how much the shift volume grows after it leaves the basic category. No estimate of this is available but if the growth is high, the postal service loss for the program could be low, which would yield a discount larger than 4.5¢. The fourth statement is to set the discount equal to the savings at the margin. This leads to the current discount of 6¢, which is where the lines in Figure 9 cross.

Although the lines in Figure 9 appear to cross, based on the models in Part II, it is interesting to consider the possibility that they may not. Suppose ECP at the margin could be pursued with full knowledge of the effects. We might increase the discount to 7¢ and find that we saved 7.3¢ on the volume that shifted. Then we might increase it to 8¢ and find that we saved 8.2¢ on the volume that shifted. Then we might increase it further. If this process continued, it might lead to a situation where all of the collection, sorting, and

transporting of the mail is privatized. The reader is left to consider the desirability of such a result.

Part IV: Some Concluding Observations

1. In the sense that the responses drawn from mailers by worksharing discounts are based on a wide range of factors, including the consideration of factors that are not tied in any particular way to the basis for the discount, there are many types of worksharing. Assessing the advocacy of offering the discounts should include consideration of these factors. Some of the types of worksharing situations are discussed in Part I of this paper.

2. From the current position, if the price of the basic mail service is fixed and the discount for presorting can be varied, there is a powerful profit incentive for the Postal Service in the United States to reduce the presort discounts. And, importantly, the associated losses in mailer welfare are on the order of twice the increase in postal profits (net income).

3. For small to moderate movements from the current position in the United States for First-Class Mail, the technical costs associated with not having the low-cost provider do the work and the net welfare gains (or losses) appear to be small compared to the associated welfare effects, plus and minus, on the mailer groups involved. Specific estimates are provided in Part II.

4. When cross elasticities are substantial, the welfare gains are small for setting worksharing discounts larger than 100% of the savings at the margin, which is the traditional ECP position. Further, the maximum welfare position may not involve a passthrough of much more than 100%.

5. The "make-or-buy decision" is not a productive way to look at worksharing discounts. Allowing a discount to be set in this way would allow it to be based on profit maximization by the postal service. It is easy to argue that this discount for First-Class Mail in the United States might be in the neighborhood of ¾ cent. If large mailers can "presort" the mail for ¾ of a cent and the Postal Service saves 4¢, there is no profit reason for offering a larger discount.

6. Introducing a presort program and increasing the discount until a Pareto optimal position is reached will result in a much smaller discount than basing the discount on the savings at the margin. The Pareto optimal discount may be in the range of 4.5¢, while the savings at the margin appear to be in the neighborhood of 6¢.

7. The welfare findings and the advocacy of ECP are affected strongly by the magnitude of attendant cross elasticities and by whether the no-shift own-price elasticities of the workshared product are larger, the same, or smaller than those of the basic product. It goes without saying that the estimation of these elasticities is difficult and that the ones we have may not be highly accurate.

TECHNICAL APPENDIX

The text of this paper is in Microsoft Word 6.0/7.0. With the graphs, the main file is about 2.4MB. It is most easily supplied in zipped form, in which it occupies only 0.9MB and will fit on a 1.44MB disk.

The calculations of this paper were done in 5 Lotus files. These will fit on one disk.

For serious reviewers, the author would be happy to supply the paper in electronic form and would supply the Lotus files.

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