THE POTENTIAL WELFARE BENEFITS FROM
TWO-PART TARIFFS FOR BULK MAILERS

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Abstract

     The U. S. Postal Rate Commission's R2001-1 recommended rates are assumed to be the result of maximizing a social welfare function defined in consumers'-surplus space. The maximization is taken over a feasible region bounded by a zero net revenue constraint. The welfare function used in the maximization has a functional form that has previously been shown by the author to uniquely comply with the axioms of a generalized Nash bargaining model. The parameters of the function are extracted by solving a non-singular set of linear first-order conditions and a normalization equation. The fitted welfare function is then applied to derive the optimal marginal rates and fixed charges for rate systems that enlarge the feasible region by introducing two-part tariffs for various collections of bulk mailers. In general the monetary equivalents of the welfare benefits from these introductions turn out to be small in relation to U.S. postal revenues and costs. The analysis also reveals that the bulk mailers receiving the optimal two-part tariffs would usually suffer a collective loss in consumers' surplus but that mailers left with one-part tariffs would always gain.

Introduction

     Although bulk mailers must presently pay fixed charges in the form of permit fees to obtain access to bulk rates, these fixed charges constitute so small a component of postal revenues in any domestic subclass or rate category that it is hardly an exaggeration to describe current U. S. postal rates for domestic mail as a pricing system composed entirely of one-part tariffs. In this paper I evaluate the potential welfare benefits from partially replacing these one-part tariffs with two-part tariffs for selected bulk mail subclasses and rate categories. The two-part tariffs for each bulk subclass or rate category are assumed to consist of a common marginal rate per piece and non-zero customer-specific fixed charges for access to the bulk service.

     Two-part tariffs for the Postal Service's larger bulk mail customers might conceivably be installed with negotiated service agreements (NSAs) offering customers non-linear tariffs. Any non-linear tariff with a marginal rate that is monotonically non-

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increasing with volume, such as a declining block rate tariff, is equivalent after the fact
to a two-part tariff with a marginal rate and a fixed charge. The marginal rate is the rate
charged for the last unit purchased under the non-linear tariff; the fixed charge is equal
to the total revenue collected under the tariff minus the marginal rate times volume. To
comply with the assumptions of this paper the NSAs for all of the customers in a
subclass or rate category would have to be designed to yield a common marginal rate.
The remaining terms of the NSAs would then establish the customer-specific fixed
access charges. Smaller customers might be offered a standard two-part tariff with the
common marginal rate and with the fixed charge linked by a formula to business size, to
the volume of mail received, or to volumes sent over some past period of time. Virtually
any formula for determining a fixed charge will reduce to a two-part tariff so long as the
formula does not index the fixed charge directly or indirectly to the volume of mail that
the customer currently sends.

Two-part tariffs are attractive in principle because they offer a more efficient
means to collect the same revenue from postal customers than one-part tariffs. An
efficiency gain is possible because the marginal rate can be set closer to marginal cost
while postal revenue is maintained with the fixed charges. Unfortunately, the results
reported in this paper show that the welfare benefits to be derived from the introduction
of welfare-optimal two-part tariffs for bulk mailers are small. In addition, the optimal two-
part tariffs would be difficult to install with NSAs and other voluntary arrangements
because the bulk mail customers receiving the new tariffs would usually be better off
with the old one-part tariffs. For the same reason, it would be ineffective to make the
two-part tariffs optional for mailers without also raising the alternative (default) rates
paid by mailers declining the two-part tariffs.

Discussion

In a general way U.S. postal rates are the result of a compromise between the
competing social goals of equity and efficiency. Equity is served when the costs of the
postal system are distributed among postal customers, first, in accordance with
Congressional mandates and, second, in a manner that is fair in the judgment of the
Postal Rate Commission (PRC). Efficiency is served by rates that maximize the sum of

consumers' and producers' surplus. Were it not for Congressional directives to recover all current expenses, set subclass rates above their attributable costs per piece, provide free service for some mailers and set relatively favorable rates for others, efficiency would be achieved (barring other complications) by setting all postal rates equal to marginal cost. Unfortunately, marginal cost pricing would massively violate the Congressional mandates, especially the net revenue requirement that total revenue cover current expenses.

If the sum of consumers' and producers' surplus is maximized subject to just the single net revenue requirement, the resulting second-best rates are known as Ramsey rates. Ramsey rates are derived from a set of first-order conditions that simplify to the well-known inverse-elasticity pricing rule when there are no cross-price demand elasticities between subclasses. It is also possible to generalize the Ramsey rate formulas to accommodate most of the other restrictions decreed by Congress. Nevertheless, Ramsey rates have never been recommended by the PRC, at least in part, because the Ramsey formulas do not incorporate in any way the Commission's judgments of equity.

Welfare economics provides a construct, the social welfare function, to express a society's criteria for mediating equity and efficiency. In theory the social welfare function is maximized subject to the applicable constraints on production and distribution to yield the optimal solution to those classic problems of Economics 101: how much of each good to produce and how to distribute the output among consumers. The major conceptual achievement of welfare economics is the demonstration under general conditions of the existence of a set of prices and consumer transfer payments that make the social welfare solution compatible with the normal self-interested behavior of both consumers and producers.

In this context it is readily apparent that two-part tariffs must enjoy an advantage over one-part tariffs. The advantage derives from the fact that a one-part tariff is just a restricted form of a two-part tariff. With one-part tariffs both equity and efficiency are controlled solely with the marginal rates because all of the fixed charges are implicitly preset to zero. The maximization of economic welfare must be at least as effective when two-part tariffs replace one-part tariffs for any subset of subclasses or rate

categories because a two-part tariff adds an additional instrument in the form of the fixed charge. Moreover, the two parts of a two-part tariff are effectively specialized instruments. Efficiency is promoted by setting the marginal rates at, or at least close to, marginal costs. Equity in the distribution of the surpluses left to postal customers is controlled by setting the fixed access charges to recover each subclass or category's fair share of the Postal Service's institutional cost. In this respect the fixed charges work like the transfer payments of welfare theory.

A simple argument shows that replacing a one-part tariff with a two-part tariff can add Pareto superior points to a feasible set that obeys the net revenue requirement if there are no cross-price demand elasticities involving the subclass getting the two-part tariff, and, if the preexisting rate exceeds marginal cost. Construct a two-part tariff by reducing the marginal rate to marginal cost and set the fixed charge equal to the net revenue generated by the existing one-part tariff. The new two-part tariff is feasible in the absence of cross-price effects because it generates exactly the same net revenue as the old one-part tariff. It is Pareto superior because the lower marginal rate increases the consumers' surplus retained by the subclass or category getting the two-part tariff without reducing the surplus received by any other postal customers.

Some of the added consumers' surplus could be captured by the Postal Service by raising the fixed charge still further, and then using the captured surplus to lower the postal rates paid by all other customers. This way, everybody would gain some benefit from the introduction of the two-part tariff. However, this "win-win" extension of the demonstration that two-part tariffs can be Pareto superior may be misleading. A new social welfare optimum may be found among any of the points that a two-part tariff adds to the feasible set - not just among those added points that are Pareto superior. In fact most of the new vectors of consumers' surplus added to a feasible set by introducing a two-part tariff are not Pareto superior to the surplus vector produced by the old one-part rates. When the PRC revises rates to exploit the opportunity to increase social welfare with two-part tariffs, there is no assurance that the accompanying welfare judgment will leave no losers among postal customers.

The analytic approach taken in this paper is to make welfare theory operational within the limited context of postal economics. I have shown elsewhere [1] that a

generalization of the axioms of the Nash bargaining model is sufficient to uniquely determine the mathematical form of a social welfare function suitable for this purpose. Aggregate consumers' surpluses by subclass and rate category are used as surrogates for the utility indices that conventionally serve as variables of the social welfare function. The parameters of the function are then derived by assuming that the rates recommended by the PRC in the R2001-1 omnibus rate case maximize welfare subject to a net revenue constraint. Basically, the mathematics for finding optimal postal rates is worked in reverse to find the parameters of the social welfare function that explain the one-part tariffs the Commission actually recommended. Once the social welfare function has been established, the mathematics for maximizing welfare subject to a net revenue constraint can be worked forwards in the conventional way to find optimal rates and fixed charges with two-part tariffs introduced for selected bulk mail subclasses and rate categories.

The marginal rates and fixed charges that emerge from this process are the result of extrapolating the equity and efficiency judgments of R2001-1 in a way that complies with the Nash axioms. In brief these axioms require that postal rates 1) are invariant with respect to the units used to measure consumers' surplus, 2) are Pareto optimal so that no other set of rates and fixed charges leaves it possible to increase the surplus in any subclass or category without decreasing the surplus somewhere else, 3) are independent of irrelevant alternatives, meaning that adding alternatives to the feasible set must either produce new rates and fixed charges from among the added alternatives or leave the old rates and fixed charges unaffected, and 4) are the result of a fair division in the sense that the Commission would always use the same set of proportions to divide any fixed total surplus among postal customers. Marginal rates and fixed charges that do not maximize the social welfare function that I have derived from the R2001-1 Decision must somewhere violate one or another of these axioms so long as the Commission's R2001-1 criteria for balancing equity and efficiency do not change.

Overview of Findings

An early indication that the welfare benefits from two-part tariffs are small can be obtained from an analysis of the extreme case of universal two-part tariffs in which all mailers, bulk and non-bulk, are given optimal two-part tariffs. In this case the two-part tariffs obey a simple rule. The marginal rates are all equal to marginal costs thereby maximizing total consumers' surplus, and the fixed charges are relied upon only to distribute the surplus according to the proportions implicit in the Commission's social welfare criteria. Two-part tariffs for non-bulk mailers are infeasible under current legislation because they conflict with the universal service requirement. Universal service means that ordinary mailers must have access to the postal network without any connection fee such as the fixed charge in a two-part tariff. Nevertheless, the extreme case of universal two-part tariffs provides an upper bound to the welfare benefits to be derived when two-part tariffs are installed for selected bulk subclasses and categories.

In its R2001-1 Decision [3,4] the Commission's recommended rates were expected to yield about $74,751 million in revenues during the 2003 Government Fiscal Year. Attributable costs were estimated as $45,361 million leaving net revenues of $29,390 million to cover the Service's institutional costs plus a small prior years' loss recovery. The analytic approach used in this paper lets us place a value in equivalent net revenue on the welfare gain from universal two-part tariffs. It is only $2,604 million. Most of this gain is produced by the increase in total consumers' surplus that results from setting the marginal rates equal to marginal costs. The increase in the total surplus is only $2,241 million.

The potential welfare benefits have been calculated for partial extensions of two-part tariffs to First-Class presorted mail, to all Periodicals, to all Standard mail, to bulk Parcels (discounted Priority, Express, Parcel Post and BPM services), and, finally, to all of these bulk subclasses and rate categories taken together (all possible bulk mail). In every case the welfare gain is equivalent in value to only a minor increase in postal net revenue. The potential welfare gain from the introduction of two-part tariffs for First-Class presort mailers would be the same as an increase of only $434 million in net revenue. The equivalent value of the welfare gains for the other cases are similarly disappointing: $29 million for Periodicals, $1,106 million for Standard mail, $140 million

for bulk Parcels, and $1,490 million for all postal bulk subclasses and categories taken together.

A simple mechanism is largely responsibly for these small gains. The shift to two-part tariffs invariably lowers the marginal rate for every major subclass of mail, including those that do not receive the two-part tariff. These lower per-piece rates yield an increase in consumers' surplus across the entire spectrum of postal mail and service categories. This increase is offset by the fixed charges paid back to the Service by the bulk subclasses and categories receiving the two-part tariff. However, the fixed charges are not large enough to completely offset the increase in total consumers' surplus from the lower rates. The difference between the gain in consumers' surplus and the revenues recovered by the fixed charges largely explains the welfare gain from two-part tariffs. The total increase in consumers' surplus minus the total amount of the fixed charges is approximately the same as the welfare gain in each case. The residual consumers' surplus for the cases are: $572 for First-Class presort, $36 million for Periodicals, $973 million for Standard mail, $137 million for bulk Parcels, and $1,370 million for all bulk subclasses and categories together.

A perspective on how little is to be gained by introducing two-part tariffs for bulk mailers can be obtained by comparing these gains to the changes in total consumers' surplus and social welfare that would result from the substitution of Ramsey rates for the rates recommended by the Commission in R2001-1. By maximizing consumers' surplus without regard to how the surplus is distributed, Ramsey rates increase total consumers' surplus by $481 million. This is less than the surplus gained by introducing two-part tariffs for either First-Class presort, Standard mail or all bulk mailers. Thus the potential increases in consumers' surplus from two-part tariffs modestly exceeds the gain from Ramsey rates so long as at least one major bulk subclass gets a two-part tariff.

The effect of Ramsey rates must be to reduce social welfare. Otherwise, Ramsey rates would have been recommended by the PRC in its R2001-1 Decision. Nevertheless, it is a surprise to see how large a loss in social welfare would result from the adoption of Ramsey rates. The loss in welfare is equivalent to a net revenue loss of $2,535 million despite the gain of $481 million in consumers' surplus. The PRC has

always reacted negatively to suggestions from economists that it use Ramsey pricing as its method for setting postal rates. This statistic shows why. The Commission's evaluation of the loss in equity from the uncontrolled redistribution of the surplus would far exceed the value it would place on the increase it can derive from the greater efficiency of the Ramsey rates.

The root cause of this large imbalance is the criteria for judging equity that led the Commission to approve the R2001-1 rates. These rates apparently are the result of an aggressive redistribution of consumers' surplus away from several subclasses and mail categories and into other subclasses and categories that are favored by the Commission and by the provisions of the relevant legislation.   The Ramsey rates do poorly because they do not perform this redistribution.

The value of the potential welfare gains from installing two-part tariffs for all possible bulk mailers looks small when viewed alongside the potential loss from Ramsey rates. In practice, the actual welfare gain from two-part tariffs is bound to be even smaller because of the practical difficulties of installing the optimal two-part tariff for all members of an eligible subclass or bulk mail category. In practice neither the negotiations of NSAs with large mailers nor the pro-offer of a formula for the fixed charges to small mailers is likely to produce 100 percent acceptance of the two-part tariff even if the mailers in the subclass or category collectively stand to gain consumers' surplus. If the optimal two-part tariff leaves the mailers with an aggregate loss in consumers' surplus, installing the tariff by negotiation and voluntary acceptance becomes problematic.

Characteristics of Optimal Two-Part Tariffs

The landscape of the bold new world of two-part tariffs is revealed in the statistics displayed for the cases in the Appendix. It is a landscape with both expected and unexpected features. These features reveal themselves as we inspect the postal rates, fixed charges and surpluses that emerge when the social welfare function is maximized subject to the net revenue constraint.

Except for Periodicals, the R2001-1 rates for bulk mail categories were all set well above marginal cost. These rates drop dramatically when the bulk categories

receive a two-part tariff. The optimal marginal rates for the subclasses and bulk categories with two-part tariffs are always at or slightly above marginal cost. The paper includes a proof that the optimal marginal rates must equal marginal costs when cross-price effects are absent between postal customers receiving the two-part tariffs and those who do not. However, the marginal-cost pricing rule turns out to be a fairly reliable guide even when these cross-price elasticities are not zero. This happens in all cases because the cross-price elasticities between bulk mailers receiving the two-part tariffs and all other mailers are always small.

In order to make up the net revenue that is lost when marginal rates are set close to marginal costs, the optimal two-part tariffs typically include very heavy fixed charges. The totals of the fixed charges for the different cases are $11,925 million for First-Class Presort, $106 million for Periodicals, $10,067 million for Standard mail, $1,206 million for bulk Parcels and $19,578 million for all possible bulk subclasses and categories. In the last case approximately two-thirds of the Postal Service's institutional costs would be recovered through fixed access charges paid by bulk mailers!

The optimal rates for the subclasses and categories that are left with one-part tariffs are always somewhat lower than the R2001-1 rates. For example, the R2001-1 average revenue per piece for single-piece First-Class letters is 46.68 cents. This rate declines as follows: to 42.78 cents for the First-Class presort case, 46.63 cents for Periodicals, 44.48 cents for Standard mail, 46.41 cents for bulk Parcels, and 41.44 cents when two-part tariffs are installed for all possible bulk subclasses and categories. The decline in the rates paid by customers with one-part tariffs is accompanied by corresponding increases in their consumers' surplus. For First-Class Presort this increase is $2,153 million, for Periodicals $83 million, for Standard mail $3,565 million, for bulk Parcels $504 million and for all possible bulk mailers $2,268 million. These increases in consumers' surplus are the sum of increases for every subclass and category left with a one-part tariff. So the winners from the introduction of two-part tariffs always include all of the mailers who did not receive them.

On the other hand, the mailers in subclasses and bulk categories receiving two-part tariffs typically lose part of the consumers' surplus they earned under the R2001-1 rates. This is not a uniform pattern for all of the customers in all of the subclasses and

bulk categories that get the two-part tariffs. Sometimes these customers can benefit from the tariff, but more commonly they lose. Lower marginal rates always generate an additional surplus, however, some part of this additional surplus must be recovered with the fixed charges to cover institutional costs. The losses occur because the fixed charges are so high that they typically recover more revenue than the additional surplus generated by the lower marginal rates in the subclasses and bulk categories getting the two-part tariffs. The totals of these losses for bulk mailers receiving the two-part tariffs are $1,582 million for First-Class Presort, $47 million for Periodicals, $2,593 for Standard mail, $366 million for bulk Parcels, and $908 million for all possible bulk mailers.

These losses demonstrate that the introduction of optimal two-part tariffs would not be likely to leave all postal customers as winners. Usually there are some losers in the mix because two-part tariffs actually work like two kinds of taxes on selected bulk customers. A piece rate works like an excise tax while a fixed charge resembles a head tax. As with any tax system, some kinds of taxes are less destructive than others. Fixed charges are less destructive than piece rates because a fixed charge does not alter the demand behavior of the postal customer, unless it drives him out of the market altogether, while a piece rate higher than marginal cost will lead the same customer to reduce his demand for postal services below the level that is most efficient. Because of this, fixed charges are the preferred tax. In a postal tax system that mixes one-part and two-part tariffs, the mixed tariffs that maximize social welfare subject to a net revenue constraint have a strong tendency to reduce the piece rates towards marginal cost and simultaneously shift the institutional cost burden of the Postal Service onto the backs of the customers who are subject to a fixed charge.

The analysis reveals an unexpected difficulty to installing two-part tariffs with NSAs and other voluntary agreements. Given a choice between the terms of an optimal two-part tariff and a default one-part tariff consisting of the R2001-1 rate and no fixed charge, most of the bulk mailers in the cases would choose the R2001-1 one-part tariff. This occurs because the consumers' surplus derived from the old one-part tariff is usually larger than the consumers' surplus from the optimal two-part tariff. In order to make the two-part tariffs equally attractive to bulk mailers, the default rates paid by

customers who decline the two-part tariffs must usually, but not always, be raised to equalize consumers' surplus. Bulk mailers would then no longer prefer the default one-part tariff, and the Postal Service's efforts to install the optimal two-part tariffs with NSAs and by other voluntary arrangements would not meet with instant failure.

The default rates that equalize consumers' surplus for the cases have been computed and are included in the Appendix. The cases show that the default rates would typically have to be set high relative to the marginal rates in order to induce mailers to accept the two-part tariffs. In the majority of instances the default rates exceed the rates recommended in the R2001-1 Decision.

A Welfare-Economics View of Postal Rate-Making

Economic welfare theory provides a useful mathematical formalism for framing the central problem confronted by the PRC when it sets postal rates. This formalism is the problem faced by the central authority of a society when choosing a single vector of utility indices, $u^0 = \{u_i^{\,0}\}$, from a set, R_u, of feasible alternative vectors. The elements $u_i^{\,0}$ of the vector u^0 are the utility assignments made by the central authority to the members of the society. The set R_u contains all of the assignments that are possible given the society's command of resources and technology. The laws of economics are usually sufficient to allow us to assume that R_u is compact and convex. The central authority's method of choice for mapping the set R_u into the single point u^0 is to maximize a social welfare function, $W(u)$, over the set R_u. $W(u)$ is a mathematical representation of the central authority's preferences for dispensing utility among the members of the society and is assumed to be quasi-concave and differentiable.

The components of the economic welfare problem all have identifiable analogues in postal rate-making. The PRC is the analogue of the central authority. This does not mean that the Commission sets postal rates to satisfy the collective private preferences of its members. Instead, the PRC is Congress' and, more generally, society's agent and is expected to ascertain and apply Congress and society's value judgments. For this reason the members of the Commission are nominated by the President and approved by Congress for limited terms; the PRC must set rates that conform to a

variety of legislative directives imposing Congress' own preferences; the Commission must hold public proceedings that conform to standards of due process; its chosen rates must reasonably rely on the evidence presented in those proceedings; and, the rates recommended by the PRC can be modified or ignored by a unanimous vote of the Board of Governors of the Postal Service. Also, for Free-for-the-blind mail, Congress has decided that the Postal Service will provide free service, and, for International mail, Congress has assigned the Commission no role in the rate-making process. Altogether, the Commission has little scope to pursue its own agenda even if its members were so inclined.

The analogues of the members of society are mailers grouped conveniently by subclasses and categories. Most postal customers send more than one kind of mail, so grouping mailers by subclasses and mail categories means that a typical customer is represented in more than one group. The mailers in a subclass or category may also be a hodge-podge of economic entities including consumers, producers, government bodies and non-profit organizations. Nevertheless, the mailers in each group are treated collectively. This assumption allows us to define an aggregate index of utility for the group. It also allows us to avoid confronting issues of equity among the members of the groups and the resultant problems of fair division within the groups.

Finally, the postal analogue of the feasible set, R_u, consists of the set of all possible combinations of utility indexes for the groups that may be generated by alternative choices of rates and fixed charges (when they are allowed) compatible with the requirement that postal net revenues equal zero.

Consumers' Surplus

The index of utility is the sum of consumers' surplus for the mailers in each subclass or rate category. Many mailers are themselves producers of other products and services, however, they are all consumers of postal services. For an individual, consumers' surplus is equal to the addition to real income that is required to compensate the individual for a price increase that drives him out of the market. For a business, consumers' surplus is the added real cost of production after such a price increase. The PRC's analogue of the welfare problem is to choose a vector of

consumers' surpluses, $s^0 = \{s_i^{\ 0}\}$, from a set, R_s, of all feasible vectors $s = \{s_i\}$ of consumers' surplus. The method of choice is to maximize the social welfare function $W(s)$ in R_s.

The elements s_i of the surplus vector s are a subclass-by-subclass decomposition of the total consumers' surplus generated by the Postal Service as it delivers mail and performs related services with the tariffs given. The object of the rate design exercise that is an integral part of every omnibus rate proceeding is to find the piece rates and, if applicable, the fixed charges that yield the chosen vector s^0.

The quantitative results for this paper are derived from a set of postal demand functions that are assumed to be linear in the marginal rates. This assumption greatly simplifies the calculation of the surpluses for various categories of mail and special services. Let $p = \{p_i\}$ be a vector of marginal postal rates for all mail and special service categories, and let $q = \{q_i\}$ be a corresponding vector of volumes. The volume vector q is related to the marginal rate vector p by the linear equation system: $q = a + Bp$. The matrix of coefficients $B = \{b_{ij}\}$ is assumed to be real, symmetric and negative definite. In the absence of income effects the matrix B will always have these properties as a consequence of the maximizing behavior of postal customers. The individual rows and columns of B are denoted b_i. Therefore, the demand function for the *i*-th subclass or rate category is

1) $\qquad\qquad q_i = a_i + b_i p \qquad\qquad$ Postal demand function.

The matrix B is nonsingular so the inverse matrix $B^{-1} = \{b^{ij}\}$ is also symmetric and negative definite. The linear equation system can be solved to obtain a system of inverse demand functions $p = B^{-1}(q - a)$. The individual rows and columns of B^{-1} may be denoted b^j, so, the inverse demand function for an individual rate is $p_i = b^i(q - a)$.

Note that the vector product $b^i b_j$ equals one if $i = j$ and is zero, otherwise. A simple equation that we shall find useful later is $q_i = \sum_j b_{ij} b^j q$. This result is derived as follows:

$$\sum_j b_{ij} b^j q = \sum_j b_{ij} \sum_h b^{hj} q_h = \sum_h q_h \sum_j b_{ij} b^{hj} = \sum_h q_h b_i b^h = q_i$$

The elements of the vector $a = \{a_i\}$ are the volumes corresponding to free postal services. The elements of the vector $p_0 = -B^{-1}a$ are the postal rates that correspond to the zero volume vector $q_0 = 0$, that is, they are the rates that are just high enough to drive all postal customers out of all postal markets even if there are no fixed charges. So the inverse of the vector demand function can be written as $p - p_0 = B^{-1}q$ and the individual elements as $p_i - p_{i0} = b^i q$.

Consumers' surplus for a single subclass or rate category is the total net value of the service to mailers after the deduction of all payments, including any fixed charge, under a given tariff. If there are no cross-price demand elasticities and no fixed charge for access to the service, then consumers' surplus can be represented in a single-market supply/demand diagram as the area swept horizontally from the demand curve to the vertical axis and vertically from the vertical intercept to the marginal piece rate. Mathematically, this area is equal to the integral of the single-service demand curve taken between the given rate and the rate that drives all mailers from the market p_{i0}. The classic economic interpretation of this bit of calculus is that the value gained by the consumer is the sum of the prices he is willing to pay minus the price he actually pays for the additional units he buys as the price of the service is lowered from p_{i0} to p_i.

The correct mathematical extension of this concept when there are nonzero cross-price elasticities is a line integral along a path from p to p_0. The integral for consumers' surplus (without a fixed charge) is $\int_p^{p_0} q_i dx_i = \int_p^{p_0} (a_i + b_i x) dx_i$ where x denotes a price vector along the path. To construct the line integral x is parameterized by a variable t with a range [0,1]. The equation for x is $x = tp_0 + (1-t)p$ and $dx = (p_0 - p)dt$. The line integral is obtained by substituting for x and dx_i in the integral as follows:

$$\int_p^{p_0} q_i dx_i = \int_0^1 (a_i + b_i(tp_0 + (1-t)p))(p_{i0} - p_i)dt$$

Performing the integration and simplifying yields:

$$\int_p^{p_0} q_i dx_i = -(p_{i0} - p_i)b_i(p_0 - p)/2$$

The rates may be replaced with volumes by substituting $p_0 - p = -B^{-1}q$ and

$p_{i0} - p_i = -b^i q$, and noting that $b_i B^{-1} q = q_i$. Therefore: $\int_p^{p_0} q_i dx_i = -(q_i b^i q)/2$

The sum of consumers' surplus without fixed charges over all subclasses and rate

categories is the quadratic form $-\sum_i (q_i b^i q)/2 = -q' B^{-1} q/2$.

One purpose of the derivation here is to show that consumers' surplus

decomposes by subclass and rate category so that the vector of surpluses s is a valid

surrogate for the vector of utility indexes in the social welfare function. Fixed charges

are just simple deductions from the consumers' surpluses that would otherwise be

retained by mailers. Let $f = \{f_i\}$ be a vector of fixed charges whose elements are the

total fixed charges paid by all mailers in a subclass or category for access to the

service. The consumers' surplus retained by mailers using the i-th subclass or mail

category is:

2) $s_i = -(q_i b^i q)/2 - f_i$ Consumers' surplus for subclass or
                                                          category i.

The consumers' surplus vector s is nonnegative because mailers always have the

option of reducing their volumes q_i to zero rather than pay the fixed charge f_i. The

existence if this recourse makes it impossible for the PRC to set marginal rates and

fixed charges that drive s_i below zero for any subclass or category. On the other hand,

the null vector $s = 0$ cannot lie within the feasible set R_s if the Postal Service has a

positive fixed cost. At $s = 0$ we have $p = -B^{-1}a$ and $f = 0$. Therefore, at the origin the

Postal Service recieves no revenue either from the rates or from the fixed charges. The

net revenue constraint cannot be met at the origin if there are any costs that are not

volume-variable.

The Social Welfare Function

The PRC's rate recommendations are assumed to obey a generalized version of the axioms of the well-known bargaining model of John Nash [2]. I have shown previously [1] that these axioms are sufficient to uniquely determine the mathematical form of the social welfare function $W(u)$ that must be maximized to map any feasible set R_u into the welfare solution u^0. The method of choice used by the central authority is assumed to be equivalent to maximizing $W(u)$ in R_u.

The utility indexes of the Nash model are assumed to be Neumann-Morgenstern cardinal utility indexes. It is also convenient to assume that the set R_u is closed, bounded and convex, however, this assumption is a convenience to ensure the existence of a finite maximum of $W(u)$ in R_u and is not strictly necessary.

There are four axioms that the mapping of R_u into u^0 is assumed to obey:

- *Axiom 1*: <u>Invariance with respect to utility transformations.</u> Let a linear transformation be performed on the utility indexes as follows: $\bar{u}_i = a_i u_i + b_i$ with $a_i > 0$ for all i. Let $\bar{R}_u$ be obtained from R_u by the same transformation. Let u^0 and $\bar{u}^0$ be the chosen welfare solutions in R_u and $\bar{R}_u$ respectively. Then u^0 and $\bar{u}^0$ are related by the same linear transformation, $\bar{u}_i^0 = a_i u_i^0 + b_i$ for all consumers *i*.

- *Axiom 2:* <u>Pareto optimality.</u> Let the vector u^0 be the chosen welfare solution in R_u. Then there must be no vector u contained in R_u such that $u \geq u^0$, i.e., $u_i \mathrel{>=} u_i^0$ for all *i* and $u_i > u_i^0$ for at least one consumer *i*.

- *Axiom 3:* <u>Independence of irrelevant alternatives.</u> Let the vector u^0 be the chosen welfare solution in R_u. Let $\bar{R}_u$ include R_u and let $\bar{u}^0$ be the chosen welfare solution in $\bar{R}_u$. Then either $u^0 = \bar{u}^0$ or $\bar{u}^0$ is not contained in R_u.

- *Axiom 4:* <u>Non-symmetric fair division.</u> Let the central authority specify a vector of positive parameters $\boldsymbol{w} = \{\boldsymbol{w}_i\}$ with one element for each consumer *i*.

Suppose that the set R_u is defined as $\left\{ u >= 0, \sum_i u_i = 1 \right\}$. The chosen welfare

solution u^0 in R_u will then obey the following rule: $u_i^{\,0} = k w_i$ for all *i*, and

$k > 0$.

The only social welfare function that is compatible with these four axioms when it

is maximized in R_u is the function $W(u) = \prod_i (u_i - \bar{u}_i)^{w_i}$ where $\bar{u}_i$ is the value of the *i*-th

consumer's utility at the origin, i.e., when the *i*-th consumer's consumption of all goods

is zero. The uniqueness of $W(u)$ follows directly from two Theorems for which the

proofs may be found in [1]:

- *Theorem 1*: Mapping R_u into u^0 by maximizing $W(u) = \prod_i (u_i - \bar{u}_i)^{w_i}$ in the

  compact and convex set R_u obeys the four axioms.

- *Theorem 2*: If the central authority maps R_u into u^0 by maximizing a social

  welfare function in R_u, then $W(u) = \prod_i (u_i - \bar{u}_i)^{w_i}$ is the only function which

  may be used for this purpose without leading to a violation of the four axioms.

Neither of the theorems precludes transformations of $W(u)$ that leave unaffected

the mapping of R_u into u^0. A positive linear transformation of the welfare function is

such a transformation. Let $\overline{\overline{W}}(u) = a + b W(u)$ with $b > 0$, then both $\overline{\overline{W}}(u)$ and $W(u)$ have

the same solution u^0 in R_u. The logarithmic transformation $\overline{W}(u) = \ln W(u)$ also leaves

u^0 unaffected.

A social welfare function, $W(s)$, that uses consumers' surplus by subclass and

mail category as a surrogate for the Neumann-Morgenstern utility indexes, and that

complies with the four axioms of the generalized Nash bargaining model is:

$$W(s) = \prod_i s_i^{\,a_i} \text{ with } a_i > 0 \text{ for all } i \text{ and } \sum_i a_i = 1$$

The minimum value of any element s_i of a vector s contained in the feasible set R_s is zero. Therefore, s_i replaces $(u_i - \bar{u}_i)$ in the social welfare function. The parameters a_i are obtained by scaling the elements of the vector $w = \{w_i\}$ as follows:

$$a_i = w_i \bigg/ \sum_j v_j$$

This is a positive linear transformation of the welfare function such that the new parameters a_i remain positive for all subclasses and sum to one.

The natural logarithmic form of the social welfare function is convenient for applications. This form is linear in the parameters a_i and is strictly concave in the nonnegative orthant, i.e. for $s >= 0$.

3) $\ln W(s) = \sum_i a_i \ln s_i$ Log postal welfare function.

with $a_i > 0$ for all i and $\sum_i a_i = 1$

The elements $\dfrac{\partial^2 \ln W}{\partial s_i \partial s_j}$ of the matrix of second-order partial derivatives of $\ln W(s)$ are $-a_i / s_i^2$ if $i = j$ and zero otherwise. Therefore, the matrix is negative definite in the nonnegative orthant and $W(s)$ is quasi-concave.

Using consumers' surplus as a proxy for Neumann-Morgenstern utility indexes entails making two assumptions about mailers' utility, or, at least, about the way the PRC views this utility. The first assumption is that the marginal utility of money is constant, and the second is that mailers' utility is invariant with respect to risk. Both of these assumptions are simplifications that are necessary to make the abstract mathematics of welfare economics operational. The first assumption allows us to perform arithmetic with consumers' surplus and equate the results to mailers' utility. Postage is typically not a very large component of either a consumer's income or of a business's cost, so the marginal utility of money to mailers should be approximately constant over any of the alternative tariffs that the PRC might consider in a rate case. Invariance with respect to risk means that mailers are indifferent between more-or-less

risky outcomes with the same expected consumers' surplus. If volume is uncertain then the variance of a mailer's total charge for postal service is affected by the combination of piece rates and fixed charges that is used to collect it. The risk is levered downwards when the proportion collected as a fixed charge increases. Nevertheless, invariance with respect to risk may be defended like the first assumption by observing that the dollar amounts involved are too small for the differences in risk to be sensible to most consumers and businesses.

The four axioms of the Nash bargaining model constitute a strong characterization of the interpersonal preferences of a central authority. In contrast, the characterization of social welfare functions implicit in most of the welfare literature is a weak one. Typically, the only assumption made about $W(u)$ is that it is differentiable and quasi-concave. This weak characterization does not yield a specific functional form and cannot be made operational without additional assumptions. On the whole, I think that it would be impossible to find a set of additional assumptions, sufficient to determine the form of the social welfare function, that is less arbitrary and more reasonable than the generalized Nash axioms.

Axiom 1 means that the PRC's method of choice and criteria for mediating among mailers is invariant with respect to the units of account used to measure consumers' surplus. Rate decisions will conform to Axiom 1 if the Commission is free of money illusion, i.e., the relative distribution of consumers surplus among mailers is unaffected by the choice of units for keeping the accounts.

Axiom 2 applies the economist's standard test for efficiency, Pareto optimality, to postal rate decisions. A tariff fails the efficiency test if it leaves an opportunity to increase the consumers' surplus gained by the mailers in any subclass or rate category without simultaneously decreasing the consumers' surplus gained by the mailers in any other subclass or category. Axiom 2 effectively disqualifies any social welfare function that is not an increasing function of consumers' surplus in every subclass and category.

Axiom 3 means that adding new possibilities to the feasible set R_s cannot affect the Commission's relative ranking of the alternatives in the original set. The introduction of two-part tariffs provides a good example of what cannot happen. Since one-part tariffs are just two-part tariffs without fixed charges, two-part tariffs add new points to the

feasible set. These new points consist of the new combinations of consumers' surplus made possible by the opportunity to mix piece rates and fixed charges. Suppose, upon contemplating the new opportunities offered by two-part tariffs, the PRC still chooses a one-part tariff for all subclasses and rate categories. These one-part tariffs cannot be different from the ones the PRC would have chosen if the two-part tariffs had not been included as possibilities. If the Commission changes the rates, it must choose a two-part tariff with a nonzero fixed charge for at least one subclass or rate category.

If a violation of Axiom 3 actually should occur there might be a number of "reasonable" explanations. The PRC's information regarding postal demand or costs of service may have changed. The parameters of the Commission's social welfare function may also be changing over time. The points that are added to the feasible set may be seen as having some strategic value as "bargaining" points even if one of them is not actually chosen. Finally, the Commission's own internal decision processes might be so flawed that the Commission is unable to conform its decisions to Axiom 3. The analysis presented in this paper abstracts from all of these possible complications. The Commission's information and preferences are treated as unchanging; issues of strategy and imperfect decision processes do not arise. In the final analysis, Axiom 3 asserts that the PRC is always able to select postal tariffs in a consistent and rational way when it is given the necessary information about the set R_s.

Axiom 3, together with Axiom 2, effectively rule out methods of choosing postal rates that are not equivalent to maximizing a social welfare function over the feasible set. Examples of the kinds of methods forbidden by Axiom 3 include choosing a solution at random from the set R_s, any kind of averaging of the elements of the set, and processes that yield solutions by consent between mailers and the Postal Service. All of these methods carry the potential to violate Axiom 3; maximization of $W(s)$ in R_s does not.

Axiom 4 specifies a neutral mechanism to quantitatively define the criteria the PRC applies when it chooses rates. Axiom 4 confronts the PRC with the hypothetical problem of fairly dividing one dollar among mailers. The dollar can be divided in any way that the Commission chooses so long as every mailer receives some part of it. There is nothing about the problem that favors or disfavors any particular subclass or

rate category, so the outcome is solely determined by the Commission's criteria for judging equity among mailers. The parameters a_i are the PRC's fair division of one dollar among mailers grouped by subclass and rate category.

However, Axiom 4 does far more than simply specify how the Commission would divide a dollar. Axiom 4 requires that the proportions that fairly divide a dollar must be applicable to the fair division of any fixed surplus among mailers. If the feasible set R_s is defined to allow any distribution of a fixed total surplus, say $\sum_i s_i = T$, the division of this surplus is $s_i = a_i T$ for all i. Axiom 4 excludes social welfare functions that fail to make this fair division correctly.

Axiom 4 is largely responsible for the unique form of the social welfare function in equation 3. Under this axiom the PRC's equity standards are assumed to be invariant with respect to the total amount of consumers' surplus generated and redistributed by the chosen rates and fixed charges. This invariance means that the proportions a_i must be the sole parameters of the social welfare function. Equation 3 is the only way that this parsimonious set of parameters can be arranged in a social welfare function that will always divide a simple fixed surplus in the correct proportions.

The Postal Welfare Problem

The postal welfare problem is to maximize the logarithmic form of the social welfare function 3) over a feasible region that is determined solely by the net revenue condition - that total postal revenue is equal to total postal costs.

The net revenue condition is not the only constraint that Congress imposes upon the rate recommendations of the PRC, however, it is by far the most important. The other conditions imposed by Congress include the requirement that subclasses other than non-profits receive rates that equal or exceed "attributable" costs per piece, and that non-profit rates equal various percentages of the rates for comparable standard service. However, unlike most of these other conditions, the net revenue condition is always a binding constraint.

The additional Congressional conditions are difficult to add as simple constraints to the postal welfare problem for several reasons. First, attributable cost per piece is a

postal accounting definition that includes average single-subclass fixed costs as well as marginal costs. Congress' intent in prescribing the attributable cost test was probably to prohibit cross-subsidies at the subclass level. However, this test is now known to be necessary but not sufficient. A sufficient test for the existence of cross-subsidies in rates, the incremental cost test, is not required by present law. Although the PRC has never explicitly applied the incremental cost test in an omnibus rate decision, the recommended rates have always been set somewhat <u>above</u> their attributable cost floors. This may reflect a desire by the Commission to respect the intent of Congress to avoid all possible cross subsidies as well as obey the actual letter of the law.

Non-profit standard mail provides an example of the kind of linkage Congress has recently enacted between non-profit and comparable regular-rate services. The average rate that the Commission recommends for non-profit standard-mail must not exceed 60 percent of the rate for regular-rate standard mail.   Unfortunately, it is not helpful to simply introduce all of the Congressional restrictions as additional constraints in the postal welfare problem. The restrictions altogether constitute a fairly large set of linear inequalities each of which involve one or more subclass rates. There is no way to establish *a priori* which of these constraints are binding, so adding the constraints yields a mathematical programming problem without a simple analytic solution. Second, problems arise when one attempts to apply the Congressional restrictions to two-part tariffs. In general the legislation mandating the restrictions contain no provisions dealing with fixed charges for access to service. So it is unclear how to write a linear constraint to express the intent of Congress as it would apply, for example, when linked non-profit and regular-rate subclasses are offered two-part tariffs. Third, legislation is not the only method that Congress employs to describe its preferences to the PRC.

A simple implicit solution to the problem of incorporating Congressional mandates and preferences in the postal welfare problem is to regard them as part of the information that the Commission subjectively processes to produce the parameters of the social welfare function. This treatment leaves the net revenue condition as the sole effective constraint but means that we must regard the social welfare function $W(s)$ as embedding the intent of Congress.

The postal cost function is assumed to be linear in volume, i.e., the marginal costs for each subclass and category do not vary with volume. Postal net revenue is total current expenses minus total current revenue. This definition does not correspond precisely to the economic cost of postal service because it includes depreciation rather than the opportunity cost of the Service's owned land, structures and equipment, however, it is the definition specified by Congress in the controlling legislation. The Commission's rate recommendations must leave a net revenue of zero for a future "test" year when all sources of current postal costs and revenues are included.

4) $\quad IC + \sum_i MC_i q_i - \sum_i p_i q_i - \sum_i f_i = 0 \qquad$ Net revenue constraint.

Total cost is equal to the sum of institutional cost (including the net amount of other fixed costs and revenues), IC, and volume-variable cost, $\sum_i MC_i q_i$. MC_i is the marginal cost of the i-th subclass or rate category and $MC = \{MC_i\}$ is the marginal cost vector. Postal revenues consist of the revenues from the average piece rates, $\sum_i p_i q_i$, and the total of the fixed access charges, $\sum_i f_i$.

The welfare solution is located by solving a set of first-order conditions derived by taking partial derivatives of a Lagrangean with respect to all of the elements of the rate vector p and those elements of the vector f of fixed charges that are permitted to be nonzero as part of a two-part tariff. The Lagrangean is:

$$L = \sum_i a_i \ln s_i - I \left[IC + \sum_i MC_i q_i - \sum_i p_i q_i - \sum_i f_i \right]$$

with $s_i = -(q_i b^i q)/2 - f_i$, $q_i = a_i + b_i p$ and the multiplier I for the net revenue constraint. The partial differential of L with respect to an element p_i of p is:

$$\frac{\partial L}{\partial p_i} = -\sum_j \frac{a_j}{s_j} \frac{\partial (q_j b^j q)/2}{\partial p_i} + I\left[q_i + b_i (p - MC) \right] \text{ with } \frac{\partial (q_j b^j q)/2}{\partial p_i} = \left[b_{ij} b^j q + q_j b^j b_i \right]/2$$

The vector product $b^i b_j$ equals one if $i = j$ and is zero otherwise so

$$\frac{\partial (q_j b^j q)/2}{\partial p_i} = -\frac{b_{ij}(s_j + f_j)}{q_j} + \{q_j/2 \text{ if } i = j.$$ Substituting in the partial derivative of the

Lagrangean and setting the result to zero gives the first-order conditions with respect to the elements of p.

5a) $$\sum_j \frac{a_j b_{ij}}{q_j} \frac{(s_j + f_j)}{s_j} - \frac{a_i q_i}{2s_i} + I[q_i + b_i(p - MC)] = 0 \text{ for all } i.$$

Differentiating L with respect to a nonzero element f_i of f: $\dfrac{\partial L}{\partial f_i} = -\dfrac{a_i}{s_i} + I$.

Setting this partial derivative to zero gives the first-order conditions corresponding to the nonzero fixed charges.

5b) $$-\frac{a_i}{s_i} + I = 0 \text{ for all } i \text{ with } f_i \text{ nonzero.}$$

Most of the results reported in this paper are produced by applying the first-order conditions 5a) and 5b) in various ways.

Fitting the Welfare Function

The parameters a_i of the social welfare function applied by the Commission in a rate decision may be extracted from the one-part tariffs recommended by the Commission by solving a system of equations consisting of the conditions 5a) and $\sum_i a_i = 1$. With all fixed charges set to zero there are no conditions 5b) and the conditions 5a) become:

$$\sum_j \frac{a_j b_{ij}}{q_j} - \frac{a_i q_i}{2s_i} + I[q_i + b_i(p - MC)] = 0 \text{ for all } i$$

The system consisting of 5a) and $\sum_i a_i = 1$ is linear in the parameters a_i and the

Lagrangean multiplier I. The coefficient matrix is nonsingular and the system can be

solved by the usual matrix methods for the unique vector $\boldsymbol{a}^0$ and multiplier $\boldsymbol{l}^0$ that yield the recommended rates as the solution to the welfare problem.

The multiplier $\boldsymbol{l}^0$ is the rate at which net revenue converts to the natural logarithm of welfare. Its inverse, $1/\boldsymbol{l}^0$, is the rate at which marginal changes in $\ln W$ convert back to net revenue. The value of $1/\boldsymbol{l}^0$ derived from the PRC's R2001-1 decision is used to place dollar values on the changes in welfare that would result from the adoption of Ramsey rates and from re-optimized rate systems in which various collections of bulk subclasses and rate categories are allowed to receive two-part tariffs.

Universal Two-Part Tariffs

When it is possible to install two-part tariffs for all subclasses and categories of mail, the conditions 5a) and 5b) have a particularly simple solution. They are solved by setting all of the marginal rates equal to marginal costs and by setting the fixed charges so that the shares of total consumers' surplus left to mailers in each subclass or rate category are equal to the welfare parameters $\boldsymbol{a}_i$.

The conditions 5b) hold for all subclasses and rate categories so they can each be used to make the substitution $\boldsymbol{l} = \boldsymbol{a}_i/s_i$ in the corresponding condition 5a) to obtain:

$$\sum_j \frac{\boldsymbol{l}\,b_{ij}}{q_j}(s_j + f_j) \;-\; \frac{\boldsymbol{l}q_i}{2} + \boldsymbol{l}\left[q_i + b_i(p - MC)\right] = 0$$

$\boldsymbol{l}$ cancels out and the substitution $s_j + f_j = -q_j b^j q/2$ leaves:

$$-\sum_j b_{ij} b^j q \Big/ 2 + q_i/2 + b_i(p - MC) = 0.$$

The sum in the expression is just $-b_i b^j q/2 = -q_i/2$ because $b^i b_j$ equals one if $i = j$ and is zero otherwise. So, the conditions 5a) reduce to $b_i(p - MC) = 0$ for all i. Since the matrix B is nonsingular these conditions are generally satisfied only for $p = MC$.

The conditions 5b) may each be multiplied by s_i and then summed to get $-\sum_i \boldsymbol{a}_i = \boldsymbol{l} \sum_i s_i$. Since $\sum_i \boldsymbol{a}_i = 1$, we have $\boldsymbol{l} = 1 \Big/ \sum_i s_i$. Substituting for $\boldsymbol{l}$ the conditions

5b) become $s_i = a_i \sum_j s_j$. The fixed charges for universal two-part tariffs can be

extracted by substituting for s_i in the formulas 2) for consumers' surplus:

$$f_i = \left[a_i \sum_j q_j b^j q - q_i b^i q \right] \Big/ 2 \text{ for all } i$$

Universal two-part tariffs make possible efficient marginal cost pricing of postal services by supplying separate and sufficient instruments for addressing issues of equity and efficiency. Marginal cost pricing maximizes the consumers' surplus available for redistribution by means of the fixed charges. This maximization applies to any welfare function because it is independent of the parameters a_i. The welfare parameters are only needed to set the proportions for the redistribution of the total surplus among the subclasses and categories. They are used in this capacity solely to determine the fixed charges.

Universal two-part tariffs provide an upper bound to the potential welfare gain to be derived from the adoption of two-part tariffs for any subset of postal subclasses and rate categories. This bound is entirely hypothetical under the current universal service obligation. The universal service obligation effectively bans the Postal Service from collecting fixed charges in the form of access fees from any non-bulk mailers.

Ramsey Rates

Ramsey rates maximize the sum of consumers' surplus, $-\sum_i q_i b^i q / 2$, and

producers' surplus, $\sum_i (p_i - MC_i) q_i$, subject to the net revenue constraint 4) and with no

fixed charges. The net revenue constraint becomes $IC + \sum_i MC_i q_i - \sum_i p_i q_i = 0$. The

Lagrangean for the Ramsey problem is:

$$L = -\sum_i (q_i b^i q) / 2 + \sum_i (p_i - MC_i) q_i - m \left[IC - \sum_i (p_i - MC_i) q_i \right]$$

with the multiplier m for the net revenue constraint. The first-order conditions for the Ramsey rates are found by setting to zero the partial derivatives of the Lagrangean with respect to all of the elements of the rate vector p . These first-order conditions are:

$$6) \qquad \frac{\partial L}{\partial p_i} = -\sum_j \frac{\partial (q_j b^j q)/2}{\partial p_i} + (1+m)\left[q_i + b_i(p - MC)\right] \text{ for all } i.$$

The Ramsey conditions 6) are second-best efficiency conditions that do not enforce any equity criteria for distributing consumers' surplus among mailers. Nevertheless, the conditions can be shown to arise as solutions to the postal welfare problem in two special circumstances. The Ramsey conditions 6) are identical to the first-order conditions 5a) for a welfare solution, first, with all fixed charges set to zero, when the welfare solution fortuitously divides the total of consumers' surplus in the proportions a_i, and, second, with all fixed charges allowed to be non-zero, when the constraint $\sum_i f_i = 0$ is added to the postal welfare problem. Each of these cases can be interpreted as corresponding to PRC rate-making in peculiarly neutral circumstances.

In the first case we have $a_i = s_i / \sum_j s_j$ for all i. Let $l = (1+m) / \sum_j s_j$ and rewrite

6) as follows: $-\sum_j \dfrac{a_j \sum_k s_k}{s_j} \dfrac{\partial (q_j b^j q)/2}{\partial p_i} + l \sum_k s_k \left[q_i + b_i(p - MC)\right] = 0$ for all i. When

divided through by $\sum_k s_k$ these conditions become identical to the first-order partial derivatives of the welfare problem's Lagrangean from which the conditions 5a) were derived.

In this case the PRC abdicates its responsibility for enforcing standards of equity among mailers by simply adopting the surplus proportions $s_i / \sum_j s_j$ that fall out of the Ramsey solution as the parameters of its social welfare function a_i. The Commission always prefers a larger to a smaller total consumers' surplus but is completely indifferent to the way the total surplus is distributed among mailers. However, allowing

the Ramsey solution to determine the parameters a_i in this way will ordinarily violate

Axiom 4 because the parameters a_i must be determinable _a priori_ for a fair division.

      For the Ramsey rates to avoid violating Axiom 4, the net revenue constraint of

the postal welfare problem must make possible a simple fair division of the total

consumers' surplus. A fair division becomes possible when non-zero fixed charges are

introduced for all mailers as in the second case. The addition of the constraint $\sum_i f_i = 0$

leaves the first-order conditions 5a) unaffected but changes the conditions 5b) to

$-\dfrac{a_i}{s_i} + \mathbf{1} + \mathbf{h} = 0$ for all _i_ with $\mathbf{h}$ as the multiplier for the additional constraint. As with the

first case, total consumers' surplus is divided according to the parameters a_i. To see

this, rewrite the conditions 5b) as $a_i = (\mathbf{1} + \mathbf{h})s_i$, then sum over all _i_ to get

$\mathbf{1} + \mathbf{h} = 1 \Big/ \sum_i s_i$ and substitute in the conditions 5b).

      Since all of the fixed charges may be non-zero, the substitution $\dfrac{a_i}{s_i} = \mathbf{1} + \mathbf{h}$ is

possible everywhere in the conditions 5a). With these substitutions 5a) becomes:

$$\sum_j \frac{(\mathbf{1} + \mathbf{h})b_{ij}}{q_j}(s_j + f_j) - \frac{(\mathbf{1} + \mathbf{h})q_i}{2} + \mathbf{1}\big[q_i + b_i(p - MC)\big] = 0$$

      Next we substitute for $s_i + f_i$ from the formula for consumers' surplus 2) and

divide through by $\mathbf{1} + \mathbf{h}$ to obtain $-\sum_j \dfrac{\partial(q_j b^j q)/2}{\partial p_j} + \dfrac{\mathbf{1}}{(\mathbf{1} + \mathbf{h})}\big[q_i + b_i(p - MC)\big]$ for all _i._

These are the Ramsey conditions 6) with $1 + \mathbf{m} = \mathbf{1}/(\mathbf{1} + \mathbf{h})$.

      The second case arises if the Commission can use fixed charges to freely

redistribute consumers' surplus even though the net contribution of the fixed charges to

postal revenue is zero. An interesting interpretation of this case is that the Ramsey

rates are welfare-optimal if the Commission can rely upon auxiliary mechanisms, not

necessarily under its control, to redistribute consumers' surplus. In fact, such

mechanisms can be found in abundance in the provisions of the federal tax code and in

the annual federal budget.   If the PRC were ever to conclude that these provisions

were sufficient to redistribute consumers' surplus equitably among mailers in the various subclasses and rate categories, then Ramsey rates would solve the welfare problem regardless of the values of the parameters a_i and the fixed charges would be redundant.

Ramsey rates are distributively neutral so the Ramsey solution is an ideal basis for measuring the equity standards that the PRC has actually applied in a rate decision. The benchmark for a single subclass or rate category used in this paper is the ratio of the welfare parameter a_i^0 derived from the rate decision to the parameter $a_i^* = s_i \Big/ \sum_j s_j$

derived from the Ramsey solution. The Ramsey ratio $a_i^0 \big/ a_i^*$ is a pure measure of the Commission's welfare criteria for a single subclass or rate category because it is a function <u>only</u> of the parameters a_i of the social welfare function.

Computing Ramsey Rates

Ramsey rates are easy to compute for linear demand and cost functions because they are simple weighted averages of the rates $p_0 = -B^{-1}a$ that correspond to the zero volume vector, $q_0 = 0$, and the marginal cost vector MC. Using matrix notation the Ramsey Lagrangean is $L = -q'B^{-1}q/2 + (1+m)(p-MC)'q - mC$. The Ramsey rates can be derived by setting to zero the partial derivatives of L with respect to the elements of q. This set of first-order conditions turns out to be a linear equation system:

$$- B^{-1}q + (1+m)\big[B^{-1}q + (p-MC)\big] = 0$$

Substitute for q using $q = a + Bp$ and solve for p to get the formula for the weighted average:

$$p = \frac{m}{(1+2m)}(-B^{-1}a) + \frac{(1+m)}{(1+2m)}MC$$

An expression for the weight $\dfrac{m}{(1+2m)}$ can be obtained by substituting for p in the net revenue constraint. The resulting quadratic is then solved for the smaller of its

two positive roots $\dfrac{m}{(1+2m)} = \dfrac{1}{2} - \sqrt{\dfrac{1-2\,IC/S_{mc}}{4}}$. The term S_{mc} is the total consumers'

surplus that would result from marginal cost pricing, i.e., setting $p = MC$. If $2IC > S_{mc}$,

then there exists no price vector p that will produce sufficient total revenue to cover

total cost. Postal net revenue reaches a maximum at $\dfrac{m}{(1+2m)} = \dfrac{1}{2}$.

Mixed Tariffs

The introduction of two-part tariffs for selected bulk mail subclasses and

categories would create a postal rate system with a mix of one-part and two-part tariffs.

The optimal rates and fixed charges for such a system of mixed tariffs must still satisfy

all of the first-order conditions 5a), however, the conditions 5b) just apply to the

subclasses and categories receiving the two-part tariffs. Only these subclasses and

categories may be given non-zero fixed charges.

In order to derive formulas that will allow us to compute the optimal marginal

rates, let us assume that the subclasses and categories indexed $i <= n$ all receive one-

part tariffs and the remainder, indexed $i > n$, all receive two-part tariffs. $(s_i + f_i)/s_i = 1$

for $i <= n$ and, from the conditions 5b), $l = a_i/s_i$ for $i > n$. Therefore, the conditions 5a)

can be rewritten in two sets corresponding to $i <= n$ and $i > n$ with l substituted for

a_i/s_i in the second set:

$$\sum_{j<=n}\frac{a_j}{q_j}b_{ij} + l\sum_{j>n}\frac{(s_j+f_j)}{q_j}b_{ij} - \frac{a_i q_i}{2s_i} + l\left[q_i + b_i(p-MC)\right] = 0 \text{ for } i <= n$$

and

$$\sum_{j<=n}\frac{a_j}{q_j}b_{ij} + l\sum_{j>n}\frac{(s_j+f_j)}{q_j}b_{ij} - l\frac{q_i}{2} + l\left[q_i + b_i(p-MC)\right] = 0 \text{ for } i > n$$

To put these conditions in a useful form we must next eliminate the non-zero

fixed charges f_i that remain for $i > n$. Rearranging the equations 2) for consumers'

surplus we have $\dfrac{s_i + f_i}{q_i} = -\dfrac{b^i q}{2}$ for $i > n$, therefore, $\displaystyle\sum_{j>n}\frac{(s_j+f_j)}{q_j}b_{ij} = -\sum_{j>n}b_{ij}\frac{b^j q}{2}$. The

sum over $j > n$ can be replaced by a sum over $j <= n$ by rearranging the equation

$q_i = \sum_j b_{ij} b^j q$ as follows:

$$-\sum_{j>n} b_{ij} b^j q = \sum_{j<=n} b_{ij} b^j q - q_i$$

Substituting we get:

$$\sum_{j>n} \frac{(s_j + f_j)}{q_j} b_{ij} = \sum_{j<=n} b_{ij} \frac{b^j q}{2} - \frac{q_i}{2}$$

The conditions 5a now become:

$$\sum_{j<=n} \frac{a_j}{q_j} b_{ij} + \textbf{1} \sum_{j<=n} \frac{b^j q}{2} b_{ij} - \textbf{1} \frac{q_i}{2} - \frac{a_i q_i}{2 s_i} + \textbf{1}[q_i + b_i (p - MC)] = 0 \text{ for } i <= n$$

and

$$\sum_{j<=n} \frac{a_j}{q_j} b_{ij} + \textbf{1} \sum_{j<=n} \frac{b^j q}{2} b_{ij} - \textbf{1} \frac{q_i}{2} - \textbf{1} \frac{q_i}{2} + \textbf{1}[q_i + b_i (p - MC)] = 0 \text{ for } i > n$$

These equations can be simplified somewhat more by collecting terms, dividing

through by $-\textbf{1}$, and using the equations 2) to make the substitutions $\frac{s_i}{q_i} = -\frac{b^i q}{2}$ for

$i <= n$.

$$\sum_{j<=n} [1 - a_j / \textbf{1} s_j](s_j / q_j) b_{ij} - [1 - a_i / \textbf{1} s_i] q_i / 2 - b_i (p - MC) = 0 \text{ for } i <= n$$

and

$$\sum_{j<=n} [1 - a_j / \textbf{1} s_j](s_j / q_j) b_{ij} - b_i (p - MC) = 0 \text{ for } i > n$$

A notational economy is afforded by letting $w_i = 1 - a_i / \textbf{1} s_i$ for $i <= n$. It is also

helpful to use the postal demand functions 1) to replace q_i with $a_i + b_i p$ where it

appears in the numerators of the equations for $i <= n$. With these changes and some

rearranging, the first-order conditions can be written in a form that is "almost" linear in

the marginal rates p.

$$\left(1 + w_i/2\right)b_i p = b_i MC + \sum_{j<=n} w_j (s_j/q_j) b_{ij} - w_i a_i/2 \text{ for } i <= n$$

and

$$b_i p = b_i MC + \sum_{j<=n} w_j (s_j/q_j) b_{ij} \text{ for } i > n$$

In this form the first-order conditions are not strictly linear in the marginal rates because the terms w_i, s_i, and q_i are all functions of the vector p. Nevertheless, the conditions can be "solved" as a linear system by treating the equations as though the terms w_i, s_i, and q_i were predetermined.

6a)
$$p = B^{-1} \begin{bmatrix} \left[b_i MC + \sum_{j<=n} w_j (s_j/q_j) b_{ij} - w_i a_i/2\right] \Big/ \left(1 + w_i/2\right) & i <= n \\ \\ \left[b_i MC + \sum_{j<=n} w_j (s_j/q_j) b_{ij}\right] & i > n \end{bmatrix}.$$

Given p and l, the other components of the solution to the postal welfare problem for mixed tariffs are:

6b)
$$q_i = a_i + b_i p \text{ for all } i,$$
$$f_i = 0 \text{ for } i <= n \text{ and } f_i = -q_i b^i q/2 - a_i/l \text{ for } i > n,$$
$$s_i = -q_i b^i q/2 \text{ for } i <= n \text{ and } s_i = a_i/l \text{ for } i > n, \text{ and}$$
$$w_i = 1 - a_i/l s_i \text{ for } i <= n.$$

Finally, the Lagrangean multiplier, l, is determined implicitly by the net revenue constraint:

6c)
$$IC + \sum_i MC_i q_i - \sum_i p_i q_i - \sum_{i>n} f_i = 0.$$

Computing Mixed Tariffs

Mixed tariffs that are optimal for a given multiplier l may be computed quickly with a simple algorithm. Let p^k be a rate vector at the start of the k-th iteration. Step 1: Compute the vectors q^{k+1}, f^{k+1}, s^{k+1} and the w_i for $i <= n$ using 6b). Step 2: Solve the

matrix equation 6a) for a vector p^*. Step 3: Compute the next rate vector as

$p^{k+1} = .25p^* + .75p^k$. Steps 1 to 3 are repeated until the iterations leave unchanged the

vectors for rates, volumes, fixed charges and consumers' surplus.   The algorithm can

be initialized at iteration $k = 1$ by choosing as p^0 the rate vector that was used to fit the

postal welfare function and the multiplier l^0 that was computed along with the welfare

parameter vector a^0.

The mixed tariff computed for l^0 will typically leave a small discrepancy in the

net revenue constraint 6c). The discrepancy can be reduced by adjusting l and then

repeating the algorithm with the previously computed rate vector as the initial vector.

Since the multiplier l is a scalar, it can be adjusted by eye and the algorithm repeated

until a solution is found that leaves no discrepancy in net revenue. The algorithm will

then have terminated with vectors for rates, volumes, fixed charges and consumers'

surplus that simultaneously satisfy all three parts of condition 6).

Zero Cross-Price Effects

We have seen that universal two-part tariffs lead to a simple marginal-cost

pricing rule for setting all marginal rates. This rule can be extended to mixed tariffs if

the cross-price demand elasticities between the subclasses and categories indexed

$i <= n$ and $i > n$ are all zero, i.e., if $b_{ij} = 0$ whenever $j <= n$ and $i > n$ (or vice versa).

With this condition met, the optimal marginal rates for the subclasses and categories

receiving the two-part tariffs are equal to marginal costs, i.e., $p_i = MC_i$ for $i > n$.

To prove this useful result, recall the equations that are "almost" linear in the

marginal rates:

$$b_i p = b_i MC + \sum_{j<=n} w_j (s_j / q_j) b_{ij} \text{ for } i > n$$

These equations become $b_i p = b_i MC$ for $i > n$.

The elements b_{ij} of the vector b_i corresponding to $j <= n$ are also zero. So the

equations can be rewritten as:

$$\sum_{j>n}(p_j - MC_j)b_{ij} = 0 \text{ for } i > n$$

The matrix B is negative definite so the principal minor corresponding to $i, j > n$ is non-singular. Therefore, $p_i = MC_i$ for $i > n$ is the only general solution to the equations.

This simple result is useful as an approximation even if the cross demand conditions are not strictly met. The subclasses and rate categories that are reasonable candidates for two-part tariffs tend to collect in groups that are characterized by strong cross-price effects within the group and weak cross-price effects with subclasses and categories outside the group. Under condition 6 the optimal marginal rates for the subclasses and categories with two-part tariffs will approach marginal cost as the cross-price effects approach zero. In fact, most cross-price elasticities between postal subclasses and rate categories are either zero or fairly small in magnitude compared to the corresponding own-price elasticities. So marginal-cost pricing should provide a good rule of thumb for approximating the optimal rates for the subclasses receiving the two-part tariffs in any reasonable system of mixed postal tariffs.

Default Rates

Default rates are one-part tariffs paid by postal customers in lieu of an optimal two-part tariff. Default rates are necessary if two-part tariffs are to be installed with negotiated service agreements (NSAs) or by offering mailers a standard two-part tariff with the fixed charge determined by a formula. Installing two-part tariffs in these ways requires the consent of the mailers receiving them. Mailers who do not negotiate an NSA or do not accept the fixed-charges generated by a Postal Service formula would be left with the one-part default rate. In order to install two-part tariffs for most bulk mailers, the default rates must be set just high enough to induce the mailers to generally prefer the two-part tariffs.

The complete vector of default rates $p^d = \{p_i^d\}$ may be partitioned into two parts corresponding to $i <= n$ and $i > n$. For $i <= n$ the default rates are the same as the one-part tariffs, i.e., $p_i^d = \overline{p}_i$, where $\overline{p}_i$ is the optimal marginal rate. The default rates for $i > n$ are obtained by solving a system of nonlinear equations. The condition that

underlies each equation is that the default rates leave mailers with the same consumers' surplus they would earn if they all accepted the optimal two-part tariff. This consumers' surplus is denoted $\bar{s}_i$ for $i > n$. The equation system is:

$$7) \qquad \bar{s}_i = -q_i b^i q / 2 = = -(p_{i0} - p_i^{\;d}) b_i (p_0 - p^d) / 2 \text{ for } i > n$$

This system is a quadratic form with real roots and is easily solved by conventional methods such as Newton's method.

Macro Data Issues

The quantitative analysis presented in the remainder of this paper is based upon the PRC's most recent omnibus rate recommendation in Docket No. R2001-1. The Commission's <u>Opinion and Recommended Decision Approving Stipulation and Settlement</u> [3] was published on March 22, 2002, and the recommended rates were installed by the Postal Service during July 2002.

The Commission's analysis of the impact of the recommended rates focused on the 2003 Government Fiscal Year (GFY 2003). This "test" year runs from October 1, 2002 to September 30, 2003. It was for this test year that the R2001-1 forecasts of volumes, revenues and costs showed that the net revenue of the U. S. Postal Service would be approximately zero. The derivation of the Commission's social welfare function, and the analyses of universal two-part tariffs, Ramsey rates and the various cases of mixed tariffs for bulk mailers have all been made in the same context.

I have used, as much as possible, the same data relied upon by the Commission in its R2001-1 Decision. This data consists, first, of the Commission's estimates for the test year of volumes, revenues per piece, attributable costs per piece and the components of the Postal Service's institutional cost as published in the Appendices to the <u>Opinion and Recommended Decision [3]</u>. Second, I have relied heavily on the R2001-1 demand studies of Postal Service witnesses Thomas Thress [5] and Gerald Musgrave [6], as did the Commission. Also, a small amount of additional information has been taken from the PRC's R2000-1 rate decision [4] and from the Postal Service's response to an information request, POIR No. 2 [7].

The data from the R2001-1 Decision meet the basic requirement for a quantitative analysis of the Commission's welfare criteria. The recommended rates, the demand functions and the cost functions comprise a matched set in the vital sense that the Commission relied simultaneously upon the demand and cost data when it accepted the rates.   However, in several general respects the data from the R2001-1 Decision are a less-than-ideal foundation. These respects are, first, the circumstances of the R2001-1 Decision were unusual and the decision process atypical of postal rate making, and, second, over the years the Commission has become increasingly skeptical of the quality of the Postal Service's data systems, statistical research and econometric studies.

In March 2002 the Commission approved without change the set of rates requested by the Postal Service in September 2001 and accepted by most major mailers in a settlement agreement of December 2001. Ordinarily, an omnibus rate proceeding takes ten months and concludes with recommended rates that differ somewhat from the Service's initial request. The PRC's motive for abbreviating the process for R2001-1 was that the terrorist attacks of September 11, 2001 and subsequent attempts to use the mail to distribute anthrax spores had unsettled economic conditions for the Postal Service to such an extent that the Service's estimates of demands and costs supporting its rate request were no longer reliable. The attacks had also created an unforeseen fiscal emergency for the Service. In the Commission's view the most appropriate response was to promptly dispose of the now-obsolete pending case in order to provide faster revenue relief, to allow economic conditions to settle, and to shorten the time needed by the Service to re-file.

The abbreviated process means that the R2001-1 rates do not bear the imprimatur of the Commission so firmly as they would, had the proceedings followed the normal course. Nevertheless, our method of analysis assumes that the R2001-1 rates are a true reflection of the Commission's welfare judgments. In truth, the PRC just co-opted the welfare judgments of the Board of Governors of the U. S. Postal Service made prior to the events of September 2001.

The postal data systems that supply the essential information for rate-making were designed long ago in an era when postal work was performed by hand with little

help from modern equipment. The descriptions of postal data systems, statistical analyses and estimates of demand and cost supplied by Postal Service witnesses during omnibus rate cases have changed very little over the years from one proceeding to the next. As recently as R2000-1 the Service was still using critical surveys of carrier activities dating from the mid 1980s. For years, the new content of Postal Service rate case presentations has been limited to cosmetic changes in existing models, to statistical reapplications using more recent data, and to a few truly new initiatives almost all of which, curiously, would have the effect of lowering the estimates of attributable cost per piece. Virtually all of these new initiatives have been discovered to be technically defective by the PRC.

The PRC has always taken a somewhat critical view of the Postal Service's efforts at data collection, statistical analysis and the resultant demand and cost estimates. The Commission's past rate decisions are laced with technical criticisms and suggestions for improvements. The Postal Service has responded grudgingly or not-at-all to most of these criticisms and suggestions, with the result that the rate of change in the data systems, statistical methodologies and economic analyses that support U. S. postal rate-making has been glacial.

Over time, the Commission's skepticism has slowly grown, and has been accompanied recently by a developing concern over the quality of postal data from Congress and the General Accounting Office. By R2001-1 the PRC's skepticism had advanced to the point that it no longer accepted major elements of the cost presentations of Service witnesses. For example, in the R2001-1 Decision the Commission's estimates of costs were based upon the methodology used by the Commission in its R2000-1 Decision. This cost methodology differed in important respects from the methodology espoused by Service witnesses.   Most noteably, the Service uses a volume variability for mail processing labor that has not been accepted by the Commission. With respect to the demand model and volume forecasts, the Commission accepted the Postal Service's methodology, possibly because it had little choice, but did not believe that the methodology was the best that could be found either for forecasting volumes or for estimating rate elasticities.

The Commission's semi-acceptance of Postal Service demand and cost models is a concern for this study because it raises the possibility that the rates may partly be a hidden response to biases that the Commission perceives in the estimates of price elasticities or per unit attributable costs. If this has happened, then the recommended rates do not entirely reflect the Commission's welfare criteria as we have assumed in the analysis. Fortunately (for this study), there is nothing in the R2001-1 Decision to suggest that the Commission subjectively re-estimated the demand and cost functions as it endorsed the proposed rates.

Micro Data Issues

A second set of data issues arise because the demand and cost functions used by the Commission in R2001-1 were designed for the purpose of determining if the recommended rates comply with various Congressional mandates, including the net revenue constraint. Our purpose is different and somewhat more exacting. This creates several practical problems that have to be solved to do the welfare arithmetic.

At the outset it is necessary to reassemble the rates and the demand and cost functions according to a single suitable set of subclass and category definitions. The definitions chosen for this study are somewhat less aggregated than any of the sets found in either the Commission's Decision or the testimony of the Service's volumes witnesses. It comprises 39 mail and service categories. Although many of our categories duplicate those used by the Commission and the Postal Service, our set is larger, first, because several subclasses are subdivided into bulk and non-bulk components and, second, because we have chosen not to combine the cost data for several smaller subclasses as was done by USPS just prior to the R2001-1 Decision.

Test year forecasts of volumes and revenues were assembled from the Commission's revenue analysis found in Appendix G of the R2001-1 Decision. The Commission's rates for the subclasses and categories are the average revenues per piece corresponding to these forecasts.

The Commission's test year forecasts of costs are located in Appendix F of the R2001-1 Decision. Marginal costs for most subclasses are estimated by dividing net attributable costs (after final adjustments but before the addition of a 3 percent

contingency) by volume. Net attributable cost includes all of a subclass's variable cost but may also include a small product-specific fixed cost or an adjustment that is not variable.   Also, the Commission's cost model is not a linear function of postal volumes, however, the cost model can be approximated quite closely over the range needed for our analysis by a linear model with constant marginal costs. Most of the Commission's per unit attributable costs correspond directly to the marginal costs of the 39 subclasses or categories used in this study. However, in several instances the Commission's costs had to be disaggregated. Depending upon the circumstances, one of two methods is used to perform these disaggregations.

The method used to divide a subclass into bulk and non-bulk categories is based upon the Commission's efficient component pricing rule. Under this rule the rate discount received by a workshared category of mail is set equal to the unit cost saving to the Postal Service of the worksharing. The marginal costs for bulk and non-bulk categories of a subclass can be estimated by solving a pair of simultaneous linear equations. Let AC be the total attributable cost of the subclass; let q_1 and q_2 be the volumes of the non-bulk and bulk categories respectively; let MC_1 and MC_2 be the marginal costs; and let p_1 and p_2 be the rates. The equations are:

$$AC = MC_1 q_1 + MC_2 q_2 \qquad \text{The definition of total attributable cost.}$$
$$MC_1 - MC_2 = p_1 - p_2 \qquad \text{The efficient component pricing rule.}$$

The solved expressions for the marginal costs of the non-bulk and bulk components are:

$$MC_1 = (AC + (p_1 - p_2)q_2)/(q_1 + q_2) \qquad \text{Non-bulk marginal cost}$$
$$MC_2 = (AC - (p_1 - p_2)q_1)/(q_1 + q_2) \qquad \text{Bulk marginal cost.}$$

The costs shown in the R2001-1 Appendix F combine several smaller subclasses of mail for which costs were reported separately in the Commission's R2000-1 Decision. These unfortunate aggregations were necessitated by a similar reduction in detail in the cost data contained in the Postal Service's annual Cost and Revenue Analysis (CRA) [8] beginning in 2001. One result of the aggregations is that the subclass definitions used by the Service's own volumes witnesses in their R2001-1 testimony are finer than the definitions found in the Service's cost data.

The method used to undo these aggregations is derived by employing the attributable costs per piece from the Commission's R2000-1 Decision as indexes. Let MC_1^* and MC_2^* be the marginal costs from R2000-1. The proportions of attributable cost for the subclasses to the aggregated total are equal to the proportions that arise from applying the R2000-1 marginal costs to the R2001-1 test year volumes:

$$MC_1 q_1 / AC = MC_1^* q_1 / (MC_1^* q_1 + MC_2^* q_2)$$

and,

$$MC_2 q_2 / AC = MC_2^* q_2 / (MC_1^* q_1 + MC_2^* q_2).$$

The marginal costs of the disaggregated subclasses are;

$$MC_1 = AC / (MC_1^* q_1 + MC_2^* q_2)$$

and,

$$MC_2 = AC / (MC_1^* q_1 + MC_2^* q_2)$$

The method is easily extended to aggregations of more than two subclasses.

The vector, a, and the matrix, B, of the demand model 1) are derived in several stages. First, a matrix of price elasticities is constructed primarily from the demand estimates of Service witnesses Thress and Musgrave. Second, the elements of the matrix of partial derivatives of the demand functions are calculated from the elasticities at the point represented by the Commission's test year volume forecasts. The matrix B is symmetric so the off-diagonal elements are calculated as the revenue-weighted averages of two cross-price partial derivatives. The diagonal elements of B are just the partial derivatives of the demand functions with respect to the own-prices. Finally, the vector, a, is found by solving the demand model 1) with the recommended rates.

The matrix of price elasticities is assembled for the same set of 39 subclass and category definitions used for the marginal costs. Where the definitions conform to those used by Thress and Musgrave the elasticities have been lifted directly from their testimony. Thress and Musgrave fit demand functions that are usually log-linear in volumes and rates. With this specification, the price elasticities correspond directly to

the coefficients of the price terms in the fitted equations. However, as with the cost data, a method must be applied to derive separate elasticities for bulk and non-bulk rate categories. Methods are also needed to derive price elasticities from discount elasticities and to derive cross-price elasticities from cross-volume elasticities. Finally, several minor own-price elasticities are simply missing from the testimony and must be estimated from other sources.

The method for calculating separate price elasticities for bulk and non-bulk categories is based upon the assumption that the volume proportions for the two categories are fixed. Let q and p be the test year volume and average rate for a subclass; let q_n and q_b be the volumes of the non-bulk and bulk components; and let p_n and p_b be the component rates . The equation for total revenue for the subclass can be rearranged as $p = p_n(q_n/q) + p_b(q_b/q)$. The ratios q_n/q and q_b/q are assumed to be fixed, therefore, $\dfrac{\partial p}{\partial p_n} = \dfrac{q_n}{q}$ and $\dfrac{\partial p}{\partial p_b} = \dfrac{q_b}{q}$. From the definition of the elasticity, e , we have $\dfrac{dq}{dp} = e\,\dfrac{q}{p}$. The desired expressions for the elasticities of q with respect to p_n and p_b are obtained by substituting in the definitions:

$$\frac{\partial q}{\partial p_n}\frac{p_n}{q} = \frac{\partial q}{\partial p}\frac{\partial p}{\partial p_n}\frac{p_n}{q} = e\,\frac{q_n}{q}\frac{p_n}{p} \qquad \text{Non-bulk rate elasticity}$$

$$\frac{\partial q}{\partial p_b}\frac{p_b}{q} = \frac{\partial q}{\partial p}\frac{\partial p}{\partial p_b}\frac{p_b}{q} = e\,\frac{q_b}{q}\frac{p_b}{p} \qquad \text{Bulk rate elasticity}$$

The equations fit by Thress for First-Class single-piece and workshared letters include the worksharing discount as an explanatory variable. This complicates the calculations of the own-price elasticities for these equations because a price change affects demand both directly through the usual rate variable and indirectly through the discount, which is a function of the rate. The discount also introduces a cross-price elasticity with respect to the workshared rate that must also be derived from the estimates. Let p_s and p_w be the single-piece and workshared rates, the worksharing discount is $D = p_s - p_w$. The econometrics leaves us with estimates of the direct effects of p_s and D on single-piece volume, q_s . These estimates are the elasticities,

$\dfrac{\partial q_s}{\partial p_s}\dfrac{p_s}{q_s} = e$ and $\dfrac{\partial q_s}{\partial D}\dfrac{D}{q_s} = b$ which can be rewritten as $\dfrac{\partial q_s}{\partial D} = b\,\dfrac{q_s}{D}$. Note also that

$\dfrac{\partial D}{\partial p_s} = 1$ and $\dfrac{\partial D}{\partial p_w} = -1$. The overall own-price elasticity of First-Class single-piece letters

is derived by substitution in a formula with two parts as follows:

$$\frac{dq_s}{dp_s}\frac{p_s}{q_s} = \frac{\partial q_s}{\partial p_s}\frac{p_s}{q_s} + \frac{\partial q_s}{\partial D}\frac{\partial D}{\partial p_s}\frac{p_s}{q_s} = e + b\,\frac{p_s}{D}$$

The formula for the cross-price elasticity has only one part as follows:

$$\frac{dq_s}{dp_w}\frac{p_w}{q_s} = \frac{\partial q_s}{\partial D}\frac{\partial D}{\partial p_w}\frac{p_w}{q_s} = -b\,\frac{p_w}{D}\,.$$

The derivation of the elasticity formulas for workshared letters is identical except
for a sign change.

Several of the fitted equations for special services have cross-volume elasticities
as parameters. These cross-volume elasticities are replaced by an equivalent set of
cross-price elasticities. To show how this is done, let us suppose that a demand

equation for a special service has the cross-volume elasticity $\dfrac{\partial q}{\partial q_c}\dfrac{q_c}{q} = g$ where q_c is the

volume from another subclass or category of mail. The demand function for q_c will

have own-price and, possibly, cross-price elasticities such as $\dfrac{\partial q_c}{\partial p_x}\dfrac{p_x}{q_c} = e_x$. The cross-

volume elasticity creates a cross-price elasticity between the special service and the

price p_x. To derive this elasticity we rewrite the elasticity expressions as $\dfrac{\partial q}{\partial q_c} = g\,\dfrac{q}{q_c}$

and $\dfrac{\partial q_c}{\partial p_x} = e_x\,\dfrac{q_c}{p_x}$, and substitute in the definition of the cross-price elasticity:

$$\frac{dq}{dp_x}\frac{p_x}{q} = \frac{\partial q}{\partial q_c}\frac{\partial q_c}{\partial p_x}\frac{p_x}{q} = g e_x\,.$$

Demand elasticities for 9 subclasses and categories are missing from the R2001-
1 testimony of Thress and Musgrave. Elasticities for two of these subclasses, USPS

Penalty mail and Free-for-the-Blind mail are not strictly necessary, since the rates for these subclasses do not change. USPS Penalty mail is the Postal Service's name for its own use of the mail. The Service always pays the marginal cost for its own mail. Free-for-the-Blind mail has its rate set at zero by statute. Own-price elasticities for the 9 subclasses and categories have been derived from other sources as follows:

- Mailgrams - same as the direct own-price elasticity of First-Class single-piece letters.

- USPS Penalty mail – a volume-weighted average of the estimated elasticities for all other subclasses of mail.

- Free-for-the-Blind mail – a volume-weighted average of the estimated elasticities for all other subclasses of mail.

- International mail – derived from the response to POIR No. 2, Item 5 (see below).

- Signature Confirmation – same as Delivery Confirmation.

- Stamped Cards - same as the direct own-price elasticity of First-Class stamped cards.

- Stamped Letters - same as the direct own-price elasticity of First-Class single-piece letters.

- Box/Caller Service - a volume-weighted average of the estimated elasticities for all subclasses of mail.

- Other Special Services – same as Delivery Confirmation.

International mail is the only major subclass of mail for which the Postal Service does not routinely provide an estimated demand function with every omnibus rate case. The PRC does not recommend International mail rates but is responsible for recommending rates for domestic mail and services that meet a net revenue constraint that includes the revenues and costs of International mail during the test year. The Postal Service supplies International mail volume and revenue forecasts for each omnibus rate proceeding but typically refuses to reveal the forecasting model. In effect, the PRC must assume that there are no cross-price elasticities with domestic rates to affect the forecasts, that the forecasts do not need to be updated for changing economic conditions, that the Commission has no reason to assess the statistical qualities of the

International mail forecasts, and that the Commission has no need to calculate the consumers' surplus for International mailers.

The own-price elasticity for International mail has been estimated as an arc elasticity using "before" and "after" forecasts of International mail volume and revenue for GFY 2003 found in the Service's response to POIR No. 2, item 5.   Although it is likely that there are non-zero cross-price elasticities with domestic mail and services, there is no way to estimate their values from the evidence presented to the Commission in R2001-1. I have assumed that all of the cross-price elasticities are zero.

Several of the demand functions supplied by the Service's witnesses have been applied to describe the behavior of both bulk and non-bulk mailers. For example, the price elasticities from Musgrave's demand function for Priority mail are assumed to apply to both the single-piece and bulk categories. This treatment entails an assumption that the cross-price elasticities between the categories are zero. A weak justification for this assumption is that the bulk rates are generally unavailable to non-bulk mailers and that bulk mailers would never choose to pay the higher rates for non-bulk service. This would not entirely prevent bulk and non-bulk mail from being either substitutes or complements, however, in the absence of any separate econometric estimates of demand functions for the two categories the assumption is unavoidable.

The partial derivatives of the demand functions with respect to the postal rates can be extracted from the elasticities at the volumes and rates forecast by the Commission for the test year. Simply rearranging the elasticity definition and inserting the values for the elasticity and the corresponding rate and volume accomplish this.

The formula is: $\dfrac{\partial q_i}{\partial p_j} = e_{ij}\dfrac{q_i}{p_j}$ where e_{ij} is the elasticity of volume, q_i, with respect to the rate, p_j.

These partial derivatives cannot simply be plugged in directly as elements of the matrix B because the resultant matrix would not be symmetric. This occurs for two reasons. First, the log-linear equation forms used by Thress and Musgrave are fundamentally incompatible with the symmetry restrictions, and, second, because the econometric methods they use are single-equation techniques that ignore the restrictions anyway. However, the symmetry of the matrix B is clearly required by the

mathematics of consumers' surplus, so there is no alternative to recalculating the elements of B in a way that respects the symmetry restrictions.

The elements of the matrix B are computed as revenue-weighted averages of the partial derivatives with the revenue weights computed for test year volumes and rates. The formula is:

$$b_{ij} = b_{ji} = \left(p_i q_i \frac{\partial q_i}{\partial p_j} + p_j q_j \frac{\partial q_j}{\partial p_i} \right) \bigg/ \left(p_i q_i + p_j q_j \right)$$

Ideally, the demand model should be respecified in a way that is compatible with the symmetry condition and refit using a method such as Constrained Generalized Least Squares that uses the information implicit in the restrictions. Short of this, revenue-weighting is probably the simplest reasonable choice for recomputing the elements of B. Typically, Thress' and Musgrave's econometric fits tend to be better for the larger subclasses and categories than the smaller ones. Revenue weighting takes this asymmetry into account by weighting more heavily the estimates of the partial derivatives that are more accurate. Furthermore, consumers' surplus is dollar-valued so it is appropriate to base the weights on revenue, which is also dollar-valued. Weights based on revenue are independent of the units of account while weights based on volume, for example, are not. Finally, it is important to remember that the role of the matrix B in our analysis is to represent how the Commission believed that volumes relate to rates during the test year. The Commission's principal concern is the net revenue requirement. Therefore, revenue-weighting corresponds to the relative weighting that the Commission would tend to give to the different estimates of the partial derivatives in the rate-making process.

The R2001-1 Decision

The recommended rates from the R2001-1 Decision are displayed alongside the Ramsey rates in the Appendix. It is immediately apparent that the two sets of rates are quite different. For example, the Commission's recommended rate for presorted First-Class letters is .3099 while the Ramsey rate for this category is .3923, a difference of almost 9 cents per piece. With presorted First-Class cards we have exactly the

opposite pattern. The recommended rate is .1850 but the Ramsey rate is only .1075. The explanation for such differences is that the Postal Service requested, and the Commission accepted, rates that aggressively redistribute consumers' surplus among the mailers in different subclasses and categories. This fact becomes clear as we examine the alpha ratios for the R2001-1 Decision.

The alpha ratios show that the Commission's social welfare function is far from neutral with respect to mailers in different subclasses and rate categories. An alpha ratio greater than one indicates a subclass or category that is favored by the PRC's fitted welfare function; an alpha ratio of one is neutral; and an alpha ratio less than one is a subclass or category that is disfavored. Very few of the 39 subclasses and categories have alpha ratios close to one. Most are either favored or disfavored, some quite heavily.

The highest alpha ratio of 1.3344 is for Inter- and Intra-BMC parcel service, the non-bulk component of Parcel Post. The category that is least favored is Express mail non-custom service with an alpha ratio of only .1282. These are the extremes, however, there are many close seconds.

The other categories that are heavily favored by the PRC's welfare function are (alpha ratios in brackets): First-Class stamped cards (1.1724) and single-piece cards (1.2556); all categories of Periodicals – within county (1.2731), regular rate (1.2588), nonprofit (1.2981) and classroom (1.2844); Parcel Service single-piece BPM (1.1954), media mail (1.2263) and library mail (1.2511). The other categories that are heavily disfavored are: First-Class presort cards (.4001); Priority mail single-piece (.5898) and bulk (.5667); Express mail customer designed service (.5891); Standard regular ECR (.3866); Special Services – money orders (.7016), return receipts (.8599), delivery confirmation (.5561) and signature confirmation etc. (.5575).

It is widely believed that the Commission favors "Aunt Minnie", the mythical patroness of First-Class single-piece letters. The Postal Service was created in the earliest days of the Republic to provide a means to deliver Aunt Minnie's mail to every part of the nation. More recently, the addition of other subclasses and services has been justified on the grounds that the added net revenue would reduce the institutional costs borne by First-Class mailers. So it is a bit surprising to discover that Aunt Minnie

is not one of the postal customers favored by the Commission in the R2001-1 Decision. Aunt Minnie's alpha ratio is .9463 while the alpha ratio for presorted First-Class letters is 1.1083. The finding that Aunt Minnie is not one of the Postal Service's favored customers is confirmed by a direct comparison of the rates. The recommended rate for First-Class single-piece letters is .4668 while the Ramsey rate is .4480. As already noted the rate for First-Class presorted letters goes from .3099 to .3923.

International mail is another subclass of particular interest. Although it is the Postal Service that sets International mail rates, it is still possible to calculate an alpha ratio for the subclass. The alpha ratio of .9269 tells us that in the context of the R2001-1 Decision, the Postal Service's rates do not favor International mailers. Again, this can be confirmed by a comparison of the Postal Service's rate, 1.5909, with the Ramsey rate for International mail, 1.5426.

"Efficient" Component Pricing

Perhaps the most important lesson to be learned from a comparison of the recommended rates and the Ramsey rates is that the efficient component pricing rule used by the Commission to set worksharing discounts is actually <u>not</u> very efficient. A worksharing discount is just the difference between the rates for pieces of mail with and without the worksharing activity, e.g. First-Class single-piece and presorted mail. Under the rule worksharing discounts are set equal to the marginal cost saving from the worksharing activity. We have already seen that marginal cost pricing is optimal if there are two-part tariffs for all subclasses and categories. Therefore, the optimal worksharing discounts would comply with the Commission's efficient component pricing rule if two-part tariffs were universal. However, the Commission is applying the efficient component pricing rule to determine discounts in a pricing system that consists entirely of one-part tariffs.

Marginal cost pricing maximizes total consumers' surplus when the net revenue constraint is absent or ineffective. However, when the constraint is present and effective the most efficient rates for a one-part tariff system are the Ramsey rates in the Appendix. The Ramsey rates are a type of second-best solution to the problem of finding the most efficient set of rates. They maximize consumers' surplus but do so

subject to a net revenue constraint that precludes setting all of the rates equal to their marginal costs. It is well-known from Lancaster and Lipsey's Theory of Second Best [9] that marginal cost pricing is not generally a property of any of the rates in such a second-best solution.

In fact the worksharing discounts implicit in the Ramsey rates do not seem to follow the efficient component pricing rule even approximately. With one huge exception the Ramsey discounts are all larger than the same discounts for worksharing in the R2001-1 Decision. The exception is the discount for presorted First-Class letters. The Commission's average discount for presorted First-Class letters is .1569; the Ramsey rates shrink this discount to .0557. The other discounts increase as follows: presorted First-Class cards go from .0560 to .1512, bulk Priority mail goes from .2400 to .2788, ECR Standard regular rate goes from .0657 to .1225, ECR Standard nonprofit rate goes from .0400 to .0477, bulk Parcels go from 3.8657 to 4.1433, and bulk BPM goes from 1.1598 to 1.5523. The general failure of the Ramsey discounts to comply with the efficient component pricing rule means that the rule, as the Commission applies it, does not constitute a good guide to efficient rate design.

The fact that the discounts implicit in the Ramsey rates are usually larger than the corresponding marginal cost differences is easy to explain. The discounts are themselves the prices of bundled services that are performed for non-workshared mail but not for workshared mail. Typically, worksharing takes the form of presorting or drop shipping, thus allowing the Postal Service to avoid performing some mail processing activity or transportation service on the workshared mail. Under the efficient component pricing rule the charge for the bundled service performed on the non-workshared mail recovers the marginal cost of the service but does not include any additional premium to help cover the Service's institutional cost. The Ramsey rates typically add the premium to the discount that the Commission's rule omits.

The Ramsey discounts may sometimes yield a negative premium because the demand model does not include specific demand equations for the bundled services. Instead, the discounts are the differences between the Ramsey rates for a non-workshared and a workshared category each of which includes a different but positive premium. There can be anomalies, such as the discount for First-Class letters, because

the demand model has different rate elasticities for the two categories. So the premium for the non-workshared category will not necessarily be higher than the premium for the workshared category. When one forms the difference the resulting premium on the discount is sometimes negative.

The Two-Part Tariffs

Solutions to the welfare problem have been computed and reported in the Appendix for six cases. For each case the Appendix displays the marginal rates and fixed charges that maximize the Commission's R2001-1 social welfare function subject to a zero net revenue condition in the test year. The default rates for the subclasses and categories receiving the two-part tariffs have also been computed and are displayed. The results for each case are summarized in a short accounting of postal revenues, costs, total consumers' surplus and the dollar value of the welfare gain. The six cases are:

1. Universal two-part tariffs – two-part tariffs are introduced for all postal subclasses and rate categories except USPS Penalty mail and Free-for-the-blind mail.

2. First-Class presort – two-part tariffs are introduced for First-Class presort letters and presort cards. All other subclasses and categories receive one-part tariffs.

3. Periodicals – two-part tariffs are introduced for all four Periodicals subclasses. These are within county, regular rate, nonprofit rate and classroom. All other subclasses and categories receive one-part tariffs.

4. Standard mail – two-part tariffs are introduced for all four categories of Standard mail. The categories are regular rate presort, regular rate enhanced carrier-route (ECR), nonprofit rate presort and nonprofit rate ECR. All other subclasses and categories receive one-part tariffs.

5. Bulk Parcels – two-part tariffs are introduced for bulk rate Priority mail, customer designed Express mail service, bulk rate Parcel Post and bulk rate Bound Printed Matter (BPM). All other subclasses and categories receive one-part tariffs.

6. All possible bulk categories – two-part tariffs are introduced for all of the subclasses and categories given two-part tariffs in cases 2 through 5. This includes virtually all mail receiving any kind of bulk discount. All other subclasses and categories receive one-part tariffs.

The quantitative results shown in the Appendix follow an unmistakable pattern that supports several general conclusions regarding the effects of introducing two-part tariffs for selected bulk subclasses and rate categories.

Our first and most important discovery is that the values of the welfare benefits to be derived from the introduction of optimal two-part tariffs are small. In every case the welfare gains translate into an equivalent increase in net revenue that is never more than a small fraction of the PRC's forecasts of postal revenues and costs during the test year. Two-part tariffs will always produce a welfare gain, so it is hard to say that the Postal Service and the Commission should not introduce them whenever possible. But it is clear from our finding that the issues raised by NSA's, volume discounts and other means of implementing two-part tariffs are minor ones in the context of U. S. postal finances.

The increase in welfare is mostly the result of an overall increase in total consumers' surplus rather than the result of a better distribution of the surplus among postal customers. This can be seen by comparing the increases in welfare values with the corresponding increases in consumers' surpluses. The increases are very similar in every case. This stands in contrast to the outcome with the Ramsey rates. With the Ramsey rates consumers' surplus increases but the welfare value sharply decreases. As noted earlier this explains why the Commission has never shown much enthusiasm for Ramsey pricing.

The practical significance of the observed correspondence between welfare and surplus is that the gains from the introduction of two-part tariffs are largely dependent upon the marginal rate reductions produced by the tariffs. Without these reductions the welfare gain would be practically nil. Alternatively, using fixed charges just to reallocate consumers' surplus does little to improve the welfare derived from a system of postal rates.

An examination of the marginal rates that are components of two-part tariffs reveals that the optimal levels for these rates are always close to, if not actually at, marginal cost. We have shown that marginal cost pricing is optimal if there are no non-zero cross-price elasticities between the subclasses and categories receiving the two-part tariffs and those that do not. The marginal rates displayed in the Appendix show that marginal cost pricing is approximately the right rule for setting the marginal rates even if the zero cross-price elasticity condition is not met. This occurs because the cross-price elasticities that are typical for postal services are small enough in magnitude to have little effect on the optimal rates.

The fixed charges that are part of the two-part tariffs also seem to be fairly easy to characterize. In all of the cases these fixed charges recover from mailers receiving the two-part tariff a total amount of revenue that is actually greater than the increase in consumers' surplus resulting from the lower marginal rates. The fixed charges do not just confiscate any gain these mailers may get from the lower marginal rates they actually shift more of the institutional cost burden onto them

This happens because fixed charges are a better way to collect postal revenue than piece rates. Raising revenue with higher fixed charges does not affect the behavior of mailers so long as it does not drive them out of the market altogether.   On the other hand, raising the piece rates above marginal cost causes an uncompensated economic loss because mailers demand less postal service than is efficient. The inefficiencies occur because customers' use of postal services ceases at a point where the value of the additional services still exceed the additional (marginal) cost of supplying them. When two-part tariffs are introduced, lowering piece rates while raising the fixed charges to maintain zero net revenue can avoid some of these inefficiencies. However, this tends to shift the burden of covering the Service's institutional costs onto the subclasses and categories receiving the two-part tariffs.

In three of the cases, First-Class presort, Standard mail and All-possible-bulk mail, two-part tariffs are introduced for major components of the mail stream. An inspection of the postal financial summaries for these cases discloses that the optimal mixed tariffs would leave the Service's finances heavily dependent upon the collection of the fixed charges from bulk mailers. The amounts to be collected for these cases are

$11,925 million, $10,067 million and $19,578 million, respectively. Clearly, any systemic failure to collect these heavy charges would be catastrophic for Postal Service finances.

Sometimes the optimal mixed tariffs imply negative fixed charges. A negative fixed charge is equivalent to a rebate. In the All-possible-bulk categories case negative fixed charges are produced for all four categories of Periodicals.   Periodicals are heavily favored by the Commission's welfare function, so much so that the optimal allocation of consumers' surplus requires rebates for these subclasses when the rates are dropped to marginal cost.

Our last observation concerns the rates for the subclasses and categories left with one-part tariffs. All of these rates go down without a single exception in every case. As a direct result, the consumers' surplus retained by mailers in these subclasses and categories goes up. Here are most of the likely winners from the introduction of two-part tariffs for selected bulk categories.

Guidelines for Two-Part Tariffs

Two of our findings are useful because they enable the Postal Service to set approximate marginal rates and establish approximate values for the fixed charges for NSAs (and for other offerings of two-part tariffs to mailers) without too much guidance from the Commission. The Service can be reasonably certain that its NSAs and other two-part tariff offerings will conform to the Commission's welfare criteria if it follows the following guidelines for customers in each subclass or category: 1) set the marginal rate at (or slightly above) marginal cost, and, 2) set each customer-specific fixed charge to recapture enough revenue to match the increase in consumers' surplus produced by reducing the piece rate from the default rate to the lower marginal rate.

An example of how these guidelines could work might be helpful. Let us suppose that the Service intends to offer a two-part tariff to a customer in a mail category with a default piece rate of .20 and a marginal cost of .10. Let us further assume that the own-price elasticity for mailers in the category has been estimated as -.50 and that any cross-price elasticities are small enough to be ignored. Finally, we must know the customer's mailings at the default piece rate. In practice this last bit of

information may be very hard to obtain, but let us assume that it is known and is equal to 1,000,000 pieces per year.

To design the approximately correct two-part tariff we must estimate the customer's mail volume when his marginal rate is dropped from the default rate to marginal cost. This can be done by fitting a linear demand curve for the customer as follows:

$$q = a + bp, \ b = e \frac{q}{p} = (-.50)\frac{1,000,000}{.20} = -2,500,000, \ a = q - bp = 1,500,000.$$

The customer's mail volume under the new marginal rate can now be estimated from his demand function: $q = 1,500,000 - 2,500,000 * (.10) = 1,250,000$.

Next, we use the formula $s = -q^2/2b$ to find the customer's surplus without a fixed charge, first, under the default rate and, second, with the marginal rate equal to marginal cost. The surplus for the default rate is $200,000 and the surplus at marginal cost before deducting a fixed charge is $312,500. Under the guidelines the approximately correct two-part tariff consists of the marginal rate of .10 and an annual fixed charge that reclaims the increase in the surplus, $112,500.

When the R2001-1 recommended rate is used to compute the fixed charge instead of the default rate, the guidelines are likely to yield a fixed charge that is lower than the optimum. However, raising the fixed charge in the tariff without raising the recommended rate creates a dilemma for the Postal Service. What mailer would accept a proffered two-part tariff that left him worse off than the recommended rate? The solution to this problem is found in the default rates displayed in the Appendix.

The default rates equalize consumers' surplus with and without the two-part tariffs. If the Commission installs the default rates as the piece rates for mailers refusing the two-part tariffs, then the guidelines work to determine the approximate two-part tariffs for mailers without the tendency to underestimate the fixed charges. Equally important, the guidelines will not produce two-part tariffs that are instantly rejected by the mailers to whom they are offered.

Conclusion

Two-part tariffs have a small but possibly useful role to play in improving the U.S. postal pricing system. The mathematics and quantitative results presented in this paper all point to that conclusion. However, it is essential to recall that these results have been reached within a regulatory context governed by several simplifying assumptions. I have assumed, first, that all of the mailers in a subclass or category receiving a two-part tariff would be offered the same marginal rate. Second, I have assumed that the Postal Service would be able to collect a predetermined aggregate fixed charge from mailers in each bulk subclass or category receiving a two-part tariff. And, third, I have assumed that the aggregate fixed charge can be fairly distributed among the mailers by means of NSAs and other voluntary agreements with the Postal Service. If these assumptions are invalid then so are the basic conclusions of this paper.

Whether or not the assumptions are valid depends almost entirely upon the institutional arrangements that are made to install the tariffs. These arrangements would have to deal effectively with several practical problems that I have conveniently set aside with the assumptions.

There is, first, the problem of economic price discrimination in the form of unequal marginal rates for mailers in the same subclass or category. There are many ways to design non-linear tariffs with NSAs and other offerings to mailers. However, most of the designs would leave mailers in the same subclass or category with unequal marginal rates. Price discrimination is inefficient because different mailers end up putting different values on the same postal service. In addition to being discriminatory, unequal marginal rates create an unwanted enforcement problem for the Postal Service. The Service must effectively prevent customers from reselling postal services. Otherwise, mailers will migrate from the Postal Service to the reselling customer with the lowest marginal rate.

A second problem arises with respect to the total revenues by subclass and category that are raised through the fixed charges (or their equivalent for a non-linear tariff). As we have seen, the optimal aggregate amounts are quite large. Installing an optimal two-part tariff for a collection of mailers requires a difficult feat of coordination because the sum of the customer-specific fixed charges must somehow be imposed by

the Postal Service within a heterogeneous collection of NSAs and other agreements with mailers. The problem is compounded by the fact that the Service is not itself a profit maximizing enterprise and, consequently, has no institutional incentive to collect the correct total amounts.

And, third, there is a problem of equity among the mailers within a subclass or category. Two-part tariffs offer obvious possibilities for redistributing consumers' surplus among individual mailers. In fact it is difficult to imagine how a two-part tariff could ever be installed in practice without redistributing the consumers' surplus from a one-part tariff among the members of a subclass or category. The redistribution might not be a concern to the Commission if <u>every</u> mailer had agreed to the two-part tariff he received. However, it is unlikely that a voluntary offering by the Postal Service to mailers could ever be this successful. In practice it would always be necessary for the Commission to verify that every mailer had been offered a two-part tariff and that the rejected offerings were fair.

If two-part tariffs are installed within a regulatory context that successfully imposes the common marginal rates, the default rates, and the total fixed charges by subclass and category, then our assumptions are applicable in principle and the analysis presented in this paper can be relied upon to determine the parameters of an optimal system of mixed tariffs. We have also found simple guidelines that, if followed, would distribute the approximately correct total fixed charge among the members of a subclass or category in a way that should not lead to massive rejections of the Service's two-part tariffs by bulk mailers. On the other hand, an uncontrolled offering of NSAs by the Postal Service to selected bulk customers is unlikely to yield any substantial part of the small welfare benefit we have found for optimal mixed tariffs. Instead, such an uncontrolled offering would probably leave in its wake a tariff system with discriminatory marginal rates, with fixed charges that fail to collect sufficient total revenue, and with a redistribution of consumers' surplus among postal customers that Congress and the PRC regard as inequitable.

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Units: All entries in $1,000	R2001-1 Decision	Universal Two-Part Tariffs	Ramsey Rates	1st Class Presort	Periodicals	Standard Mail	Bulk Parcels	All Possible Bulk Mail
Revenue from Marginal Rates	74,151,921	49,768,151	76,456,060	62,953,884	73,994,599	66,461,284	73,273,457	57,659,964
Revenue from Fixed Charges	0	30,695,754	0	11,924,619	155,821	10,066,588	1,205,988	19,577,755
Other Income	589,816	589,816	589,816	589,816	589,816	589,816	589,816	589,816
Appropriations	30,857	30,857	30,857	30,857	30,857	30,857	30,857	30,857
Investment Income	(21,948)	(21,948)	(21,948)	(21,948)	(21,948)	(21,948)	(21,948)	(21,948)
Total	74,750,646	81,062,630	77,054,785	75,477,228	74,749,144	77,126,597	75,078,170	77,836,445
Attributable Costs	44,040,042	50,196,686	46,305,575	44,773,967	44,067,089	46,375,295	44,386,531	47,064,468
Contingency (3%)	1,321,201	1,505,901	1,389,167	1,343,219	1,322,013	1,391,259	1,331,596	1,411,934
Institutional Costs	28,741,619	28,741,619	28,741,619	28,741,619	28,741,619	28,741,619	28,741,619	28,741,619
Prior Years Loss Recovery	618,424	618,424	618,424	618,424	618,424	618,424	618,424	618,424
Total	74,721,286	81,062,630	77,054,785	75,477,229	74,749,145	77,126,597	75,078,170	77,836,445
Discrepancy	29,360	0	0	(0)	(0)	(0)	(0)	(0)
Change in Consumers' Surplus								
with One-Part Tariffs			480,963	2,153,243	83,247	3,565,386	503,518	2,277,868
with Two-Part Tariffs				(1,581,604)	(47,255)	(2,592,711)	(366,332)	(907,828)
total before Fixed Charges		32,937,051	480,963	12,496,259	191,813	11,039,263	1,343,174	20,947,796
Fixed Charges		30,695,754		11,924,619	155,821	10,066,588	1,205,988	19,577,755
total after Fixed Charges		2,241,297	480,963	571,640	35,993	972,675	137,186	1,370,041
Ln of Welfare Index	10.4315	10.4474	10.4162	10.4342	10.4317	10.4383	10.4324	10.4406
Value of Welfare Change		2,603,762	(2,535,115)	434,432	29,262	1,105,607	140,189	1,489,617

	Welfare Change	Surplus Change
Universal two-part tariffs	2,603,762	2,241,297
First-Class presort	434,432	571,640
Periodicals	29,262	35,993
Standard mail	1,105,607	972,675
Bulk parcels	140,189	137,186
All possible categories	1,489,617	1,370,041

Units: Rev. & Cost/Pc. = $ per piece Surplus & Fixed Charges = $million	R2001-1 Decision			Universal Two-Part Tariffs		Ramsey Rates		
	Average Rev./Pc.	Attributable Cost/Pc.	Consumers' Surplus	Fixed Charges	Consumers' Surplus	Average Rev./Pc.	Consumers' Surplus	Alpha Ratio
Single-Piece Letters	0.4668	0.2838	44,908	10,486	44,519	0.4480	46,740	0.9463
Presort Letters	0.3099	0.1132	86,606	4,969	90,604	0.3923	81,212	1.1084
Stamped Cards	0.2300	0.2207	24	(0)	26	0.2437	22	1.1724
Single-Piece Post Cards	0.2410	0.2317	412	(31)	449	0.2587	355	1.2556
Presort Post Cards	0.1850	0.0590	653	898	467	0.1075	1,161	0.4001
Single-Piece Priority	5.3097	3.2508	3,747	2,988	3,041	4.0335	5,123	0.5898
Bulk Priority	5.0597	3.0008	893	757	712	3.7547	1,248	0.5667
Non-custom Service	16.0980	8.4397	375	977	120	9.8818	933	0.1282
Customer Designed Service	42.7192	35.0609	4	4	4	37.8977	6	0.5891
Mailgrams	0.4150	0.2829	2	0	2	0.3976	2	0.9639
Within County	0.0967	0.0936	263	(24)	289	0.1420	226	1.2731
Regular Rate	0.2983	0.2826	6,389	(498)	6,999	0.4244	5,524	1.2588
Nonprofit	0.1921	0.1953	2,026	(223)	2,242	0.3582	1,716	1.2981
Classroom	0.2824	0.2763	90	(9)	99	0.5168	76	1.2844
Regular Presort	0.2335	0.1673	16,045	3,451	15,965	0.2255	16,499	0.9614
Regular ECR	0.1678	0.0790	3,609	4,785	2,364	0.1030	6,075	0.3866
Nonprofit Presort	0.1405	0.1028	3,628	327	3,763	0.1535	3,475	1.0757
Nonprofit ECR	0.1005	0.0692	707	87	725	0.1058	690	1.0445
Inter- and Intra-BMC Parcels	6.5172	6.0335	210	(29)	232	6.6496	173	1.3344
Parcel Select	2.6515	2.1679	604	92	607	2.5063	593	1.0160
Single-Piece BPM	2.2852	2.0276	142	(3)	152	2.8212	127	1.1954
Bulk Rate BPM	1.1254	0.8679	1,364	84	1,428	1.2689	1,285	1.1040
Media Mail	1.7064	1.4993	940	(48)	1,021	2.4420	827	1.2263
Library Rate	1.8472	1.7090	173	(12)	190	2.7227	151	1.2511
USPS Penalty Mail	1.1001	1.1001	527	0	527	1.1001	527	
Free-for-the-Blind Mail	0.0000	0.8463	54	0	54	0.0000	54	
International Mail	1.5909	1.3772	1,146	294	1,125	1.5426	1,206	0.9269
Registry	9.5382	5.5037	370	27	385	11.4130	351	1.0922
Insurance	2.3280	1.7254	569	4	605	3.2131	517	1.1624
Certified	2.3000	1.6741	1,815	132	1,893	2.6603	1,721	1.0928
COD	5.7100	4.3277	17	5	16	5.2734	18	0.8829
Money Orders	1.3221	0.7885	295	172	258	1.0309	365	0.7016
Return Receipts	1.7803	1.0696	527	181	502	1.4967	580	0.8599
Delivery Confirmation	0.1128	0.0677	24	21	19	0.0835	34	0.5561
Signature Confirmation	1.7336	1.0415	2	2	1	1.2847	3	0.5575
Stamped Cards	0.0200	0.0164	2	1	2	0.0187	2	0.8465
Stamped Envelopes	0.0403	0.0314	26	3	27	0.0422	25	1.0539
Box/Caller Service	49.6003	36.8771	1,157	229	1,158	48.3741	1,179	0.9761
Other Special Services	6.7491	4.0548	20	17	16	5.0014	28	0.5575

Units: Rev. & Cost/Pc. = $ per piece Surplus & Fixed Charges = $million	Average Rev./Pc.	Default Rev./Pc.	First-Class Presort Fixed Charges	Consumers' Surplus	Percent Change Marginal	Default
Single-Piece Letters	0.4278			45,915	-8.35%	
Presort Letters	0.1394	0.3250	11,004	85,238	-55.03%	4.86%
Stamped Cards	0.2263			25	-1.59%	
Single-Piece Post Cards	0.2359			423	-2.12%	
Presort Post Cards	0.0616	0.2285	921	440	-66.71%	23.46%
Single-Piece Priority	5.2249			3,826	-1.60%	
Bulk Priority	4.9798			912	-1.58%	
Non-custom Service	16.0440			379	-0.34%	
Customer Designed Service	42.4170			5	-0.71%	
Mailgrams	0.3987			2	-3.93%	
Within County	0.0886			270	-8.33%	
Regular Rate	0.2749			6,556	-7.86%	
Nonprofit	0.1647			2,080	-14.27%	
Classroom	0.2422			92	-14.24%	
Regular Presort	0.2237			16,436	-4.19%	
Regular ECR	0.1659			3,675	-1.17%	
Nonprofit Presort	0.1328			3,720	-5.46%	
Nonprofit ECR	0.0950			725	-5.42%	
Inter- and Intra-BMC Parcels	6.4253			216	-1.41%	
Parcel Select	2.6058			619	-1.72%	
Single-Piece BPM	2.1577			145	-5.58%	
Bulk Rate BPM	1.0638			1,399	-5.48%	
Media Mail	1.5528			964	-9.00%	
Library Rate	1.6802			178	-9.04%	
USPS Penalty Mail	1.1001			527	0.00%	
Free-for-the-Blind Mail	0.0000			54	0.00%	
International Mail	1.5679			1,174	-1.45%	
Registry	8.6339			379	-9.48%	
Insurance	2.0920			584	-10.13%	
Certified	2.1462			1,861	-6.69%	
COD	5.5821			17	-2.24%	
Money Orders	1.2935			301	-2.17%	
Return Receipts	1.7242			539	-3.15%	
Delivery Confirmation	0.1111			25	-1.44%	
Signature Confirmation	1.7085			2	-1.44%	
Stamped Cards	0.0197			2	-1.46%	
Stamped Envelopes	0.0386			27	-4.02%	
Box/Caller Service	47.9529			1,186	-3.32%	
Other Special Services	6.6516			21	-1.44%	

Units: Rev. & Cost/Pc. = $ per piece; Surplus & Fixed Charges = $million	Average Rev./Pc.	Default Rev./Pc. (Periodicals)	Fixed Charges (Periodicals)	Consumers' Surplus	Percent Change Marginal	Default
Single-Piece Letters	0.4663			44,930	-0.10%	
Presort Letters	0.3091			86,650	-0.27%	
Stamped Cards	0.2299			24	-0.03%	
Single-Piece Post Cards	0.2409			412	-0.04%	
Presort Post Cards	0.1849			654	-0.06%	
Single-Piece Priority	5.3080			3,748	-0.03%	
Bulk Priority	5.0581			894	-0.03%	
Non-custom Service	16.0969			375	-0.01%	
Customer Designed Service	42.7133			4	-0.01%	
Mailgrams	0.4147			2	-0.08%	
Within County	0.0936	0.0980	4	262	-3.15%	1.33%
Regular Rate	0.2826	0.3054	163	6,338	-5.25%	2.40%
Nonprofit	0.1953	0.1897	(11)	2,031	1.66%	-1.25%
Classroom	0.2763	0.2843	0	90	-2.16%	0.66%
Regular Presort	0.2333			16,053	-0.07%	
Regular ECR	0.1678			3,610	-0.02%	
Nonprofit Presort	0.1403			3,630	-0.11%	
Nonprofit ECR	0.1004			707	-0.11%	
Inter- and Intra-BMC Parcels	6.5154			210	-0.03%	
Parcel Select	2.6506			605	-0.03%	
Single-Piece BPM	2.2826			142	-0.11%	
Bulk Rate BPM	1.1242			1,365	-0.11%	
Media Mail	1.7034			940	-0.18%	
Library Rate	1.8439			174	-0.18%	
USPS Penalty Mail	1.1001			527	0.00%	
Free-for-the-Blind Mail	0.0000			54	0.00%	
International Mail	1.5905			1,147	-0.03%	
Registry	9.5204			370	-0.19%	
Insurance	2.3233			569	-0.20%	
Certified	2.2970			1,816	-0.13%	
COD	5.7075			17	-0.04%	
Money Orders	1.3216			295	-0.04%	
Return Receipts	1.7792			527	-0.06%	
Delivery Confirmation	0.1127			24	-0.03%	
Signature Confirmation	1.7331			2	-0.03%	
Stamped Cards	0.0200			2	-0.03%	
Stamped Envelopes	0.0402			26	-0.08%	
Box/Caller Service	49.5677			1,158	-0.07%	
Other Special Services	6.7472			20	-0.03%	

Units: Rev. & Cost/Pc. = $ per piece Surplus & Fixed Charges = $million	Average Rev./Pc.	Default Rev./Pc.	Standard Mail Fixed Charges	Consumers' Surplus	Percent Change Marginal	Default
Single-Piece Letters	0.4448			45,920	-4.71%	
Presort Letters	0.2682			88,618	-13.46%	
Stamped Cards	0.2267			25	-1.45%	
Single-Piece Post Cards	0.2370			422	-1.65%	
Presort Post Cards	0.1799			665	-2.79%	
Single-Piece Priority	5.2320			3,819	-1.46%	
Bulk Priority	4.9865			910	-1.45%	
Non-custom Service	16.0485			379	-0.31%	
Customer Designed Service	42.4424			5	-0.65%	
Mailgrams	0.4001			2	-3.60%	
Within County	0.0893			269	-7.63%	
Regular Rate	0.2768			6,542	-7.20%	
Nonprofit	0.1670			2,075	-13.08%	
Classroom	0.2456			92	-13.04%	
Regular Presort	0.1692	0.2547	4,441	14,971	-27.53%	9.08%
Regular ECR	0.0790	0.2150	4,932	2,217	-52.91%	28.09%
Nonprofit Presort	0.1028	0.1489	561	3,528	-26.81%	6.04%
Nonprofit ECR	0.0692	0.1088	132	680	-31.16%	8.32%
Inter- and Intra-BMC Parcels	6.4330			215	-1.29%	
Parcel Select	2.6097			618	-1.58%	
Single-Piece BPM	2.1684			145	-5.11%	
Bulk Rate BPM	1.0690			1,396	-5.02%	
Media Mail	1.5657			962	-8.25%	
Library Rate	1.6942			178	-8.29%	
USPS Penalty Mail	1.1001			527	0.00%	
Free-for-the-Blind Mail	0.0000			54	0.00%	
International Mail	1.5699			1,172	-1.33%	
Registry	8.7112			378	-8.67%	
Insurance	2.1118			583	-9.29%	
Certified	2.1610			1,858	-6.04%	
COD	5.5928			17	-2.05%	
Money Orders	1.2959			301	-1.99%	
Return Receipts	1.7291			538	-2.88%	
Delivery Confirmation	0.1113			25	-1.32%	
Signature Confirmation	1.7106			2	-1.32%	
Stamped Cards	0.0197			2	-1.34%	
Stamped Envelopes	0.0388			26	-3.68%	
Box/Caller Service	48.0909			1,184	-3.04%	
Other Special Services	6.6598			21	-1.32%	

Units: Rev. & Cost/Pc. = $ per piece Surplus & Fixed Charges = $million	Average Rev./Pc.	Default Rev./Pc.	Bulk Parcels Fixed Charges	Consumers' Surplus	Percent Change Marginal	Default
Single-Piece Letters	0.4641			45,034	-0.58%	
Presort Letters	0.3050			86,860	-1.58%	
Stamped Cards	0.2296			24	-0.18%	
Single-Piece Post Cards	0.2405			413	-0.21%	
Presort Post Cards	0.1844			655	-0.34%	
Single-Piece Priority	5.2695			3,755	-0.76%	
Bulk Priority	3.0385	6.1305	816	647	-39.95%	21.16%
Non-custom Service	16.0918			376	-0.04%	
Customer Designed Service	35.0609	46.7902	4	3	-17.93%	9.53%
Mailgrams	0.4132			2	-0.45%	
Within County	0.0958			264	-0.96%	
Regular Rate	0.2956			6,408	-0.91%	
Nonprofit	0.1889			2,032	-1.65%	
Classroom	0.2778			90	-1.65%	
Regular Presort	0.2325			16,090	-0.41%	
Regular ECR	0.1676			3,617	-0.14%	
Nonprofit Presort	0.1396			3,639	-0.63%	
Nonprofit ECR	0.0999			709	-0.63%	
Inter- and Intra-BMC Parcels	6.3846			211	-2.03%	
Parcel Select	2.3291	2.8004	172	552	-12.16%	5.61%
Single-Piece BPM	2.2704			142	-0.64%	
Bulk Rate BPM	0.8679	1.2451	214	1,298	-22.88%	10.64%
Media Mail	1.6887			943	-1.04%	
Library Rate	1.8279			174	-1.04%	
USPS Penalty Mail	1.1001			527	0.00%	
Free-for-the-Blind Mail	0.0000			54	0.00%	
International Mail	1.5883			1,150	-0.17%	
Registry	9.4339			371	-1.09%	
Insurance	2.3172			570	-0.46%	
Certified	2.2825			1,821	-0.76%	
COD	5.6952			17	-0.26%	
Money Orders	1.3188			295	-0.25%	
Return Receipts	1.7739			528	-0.36%	
Delivery Confirmation	0.1125			24	-0.19%	
Signature Confirmation	1.7307			2	-0.17%	
Stamped Cards	0.0200			2	-0.17%	
Stamped Envelopes	0.0401			26	-0.46%	
Box/Caller Service	49.4100			1,161	-0.38%	
Other Special Services	6.7379			20	-0.17%	

Units:	All Possible Bulk Subclasses & Categories					
Rev. & Cost/Pc. = $ per piece	Average	Default	Fixed	Consumers'	Percent Change	
Surplus & Fixed Charges = $million	Rev./Pc.	Rev./Pc.	Charges	Surplus	Marginal	Default
Single-Piece Letters	0.4144			46,710	-11.23%	
Presort Letters	0.1348	0.2848	8,634	87,523	-56.51%	-8.10%
Stamped Cards	0.2238			25	-2.69%	
Single-Piece Post Cards	0.2330			431	-3.30%	
Presort Post Cards	0.0611	0.2228	910	452	-66.95%	20.41%
Single-Piece Priority	5.1411			3,881	-3.17%	
Bulk Priority	3.0348	5.9322	775	688	-40.02%	17.24%
Non-custom Service	16.0064			382	-0.57%	
Customer Designed Service	35.0609	46.0318	4	3	-17.93%	7.75%
Mailgrams	0.3874			2	-6.65%	
Within County	0.0936	0.0778	(14)	279	-3.15%	-19.54%
Regular Rate	0.2826	0.2467	(260)	6,761	-5.25%	-17.30%
Nonprofit	0.1953	0.1211	(146)	2,166	1.66%	-36.98%
Classroom	0.2763	0.1836	(6)	96	-2.16%	-35.00%
Regular Presort	0.1678	0.2457	3,981	15,423	-28.14%	5.22%
Regular ECR	0.0790	0.2124	4,865	2,283	-52.91%	26.57%
Nonprofit Presort	0.1028	0.1399	455	3,635	-26.81%	-0.38%
Nonprofit ECR	0.0692	0.1024	111	701	-31.16%	1.95%
Inter- and Intra-BMC Parcels	6.2483			219	-4.13%	
Parcel Select	2.3188	2.6988	136	586	-12.55%	1.78%
Single-Piece BPM	2.0694			148	-9.44%	
Bulk Rate BPM	0.8679	1.0984	133	1,379	-22.88%	-2.40%
Media Mail	1.4465			982	-15.23%	
Library Rate	1.5646			181	-15.30%	
USPS Penalty Mail	1.1001			527	0.00%	
Free-for-the-Blind Mail	0.0000			54	0.00%	
International Mail	1.5520			1,194	-2.45%	
Registry	8.0094			386	-16.03%	
Insurance	1.9437			594	-16.51%	
Certified	2.0417			1,894	-11.23%	
COD	5.4935			17	-3.79%	
Money Orders	1.2736			306	-3.67%	
Return Receipts	1.6855			548	-5.33%	
Delivery Confirmation	0.1100			25	-2.47%	
Signature Confirmation	1.6912			2	-2.45%	
Stamped Cards	0.0195			2	-2.47%	
Stamped Envelopes	0.0375			27	-6.80%	
Box/Caller Service	46.8122			1,206	-5.62%	
Other Special Services	6.5840			21	-2.45%	