

Voting on Prices: The Political Economy of Regulation

Gerald R. Faulhaber*

Abstract

Economists have long recognized that regulation is an imperfect solution to market failure. Do the inefficiencies of regulation outweigh the inefficiencies of market failure? In this paper, we develop a stylized model of a monopolist offering two services, one more widely demanded than the other. We compare aggregate surplus from unregulated monopoly with aggregate surplus from a median voter model of price setting in a (perfectly) regulated monopoly. We find that (i) median voter pricing can yield substantially lower aggregate surplus than monopoly pricing; and (ii) empirical evidence of the recent evolution of US telecommunications prices confirms the model.

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1. Introduction

Economists have long recognized that regulation is an imperfect solution to the problem of market failure. The term “regulatory failure” is often used to denote the inefficiencies inherent in government intervention in the marketplace. Policymakers are thus confronted with a practical problem of comparative institutions: do the inefficiencies of regulation outweigh the inefficiencies of the asserted market failure (say, of monopoly)? In this paper, we develop a simple stylized model of a (potential) monopolist offering two services, one more widely demanded than the other. We compare aggregate surplus from unregulated monopoly with aggregate surplus from a median voter model of price setting in a (perfectly) regulated monopoly. We find that (i) median voter pricing can not only yield lower surplus than monopoly pricing, it can actually yield negative surplus for one of the services; (ii) whether or not median voter pricing is surplus-inferior to monopoly pricing depends upon the elasticities of demand in the two service markets; and (iii) the more widely demanded both services become, the less is the inefficiency from median voter pricing. In addition, the model offers hypotheses regarding the recent evolution of local and toll service pricing in the telephone industry. We provide some empirical evidence from this industry that confirms these hypotheses.

At the risk of overgeneralizing, the development of regulatory economics over the past quarter century has followed two main themes: a ‘regulatory models’ theme and a Chicago School political economy theme. The first theme has focused on current industrial organization models applied to regulation, often expanding the theoretical frontiers of IO. The second theme has focused on self-interested interactions in the political marketplace of regulators and various constituencies. Each of these themes has developed substantial insight into the problems of regulation, but each has borrowed surprisingly little from the other. One objective of this paper is to apply models consistent with the first theme to the concepts of the second.

The salient history of each theme is reviewed briefly, assessing the strengths and weaknesses of each. The ‘regulatory models’ theme has had two phases: natural monopoly theory and agency theory. The first phase was ascendant during the 1970s and early 1980s, starting with Baumol and Bradford’s (1970) popularization of Ramsey pricing, through cross-subsidy analysis to sustainability and the theory of contestable markets (Baumol, Panzar, and Willig (1982)). The central problem addressed by this work is the welfare and equilibrium analysis

of market structure in which firms are characterized by scale and scope economies and marginal cost pricing does not cover total cost. Regulators are implicitly assumed to maximize welfare subject to a budget constraint, and Ramsey pricing is the answer. Contestability theory was a pre-game-theoretic analysis of market structures with such firms, with normative implications about the appropriate scope of regulation.

The second phase of the 'regulatory models' theme, agency theory, has been ascendant throughout the 1980s and 1990s, starting with the early paper of Vogelsang and Finsinger (1979) through the work of Laffont and Tirole (1993) and many others, well-summarized in Laffont (1994). It is without question the reigning paradigm of this theme of regulatory economics. The central problem addressed by this work is the asymmetry of information between regulated firms and the regulators, the strategic use of this asymmetry by firms, and appropriate responses by regulators. Agency theory goes beyond natural monopoly theory, in its recognition that regulation is far from perfect, which is a major focus of this paper. However, the agency theory approach to regulation has limitations:

- regulatory agency theory generally is focused on one very specific imperfection: asymmetric information. No other regulatory failures are encompassed;
- there is nothing inherent in agency theory that is uniquely applicable to *public*, or *government*, control of firms. This approach to regulation thus limits the analysis to those problems of public regulation that are similar to, say, firm managers trying to control workers, or firm shareowners trying to control firm managers.
- this line of research generally maintains the polite but fantastical fiction that regulators are seeking economic efficiency in their control of the industry, but are hampered in this pursuit by asymmetric information.

It is precisely these weaknesses of the 'regulatory models' theme that are the strengths of the Chicago School theme. This theme was pioneered by Stigler in the early 1960s and carried on by Peltzman, Becker and many others, well-represented in the collection of articles in Stigler (1988). The central problem addressed by this work is "demanders" of regulations (industry constituencies) using political influence to enlist "suppliers" of regulations (regulators and legislators) in order to capture market rents. In this view, regulation is not about achieving efficient outcomes (in the sense above), but rather redistributing rents using the coercive power of government.¹ Unfortunately, this powerful concept has no central organizing analytic model to fully realize it. Most of the applications of this concept (see, for example, Stigler, Peltzman, and Linneman in Stigler (1988)) have used reduced form or ad hoc models applicable to their view of the industry being studied. Becker's (1983) attempt at a more general model of political influence has had little influence on the literature since its appearance. Closest in spirit to this paper is Peltzman (1980) which uses a stylized majority-voting approach to model government tax and transfer policies. This model is used to guide the empirical analysis of cross-country tax and transfer policies to confirm the author's hypotheses. Similarly, in this paper, we also use a stylized majority-voting approach to

model the (rather narrower issue of) political choice of prices charged by a regulated utility. As in Peltzman, we subject this model to empirical test, using data from the telephone industry, 1960-1993.

Curiously, almost no efforts appear in the literature to span these two themes. A notable exception is the attempt by Laffont and Tirole (1993) to bridge this gap (Ch. 11, Regulatory Capture). They develop an interesting model of interest group politics within the overall framework of agency theory; essentially, it is an agency model with (enforceable) side payments. While it is an important step forward, it still suffers from all three of the previous objections to agency theory.

In contrast, this paper seeks to apply a simple *political economy* model to the problem of regulatory pricing, in order to compare the relative efficiency of an unconstrained monopoly market with that of voter-responsive regulators wishing to maximize their likelihood of (re)election. The political process takes center stage in this model, rather than being modeled as just another agency (or natural monopoly) problem.

This is not the first economics paper to examine voting behavior and economic outcomes. Several papers in public finance have addressed how a progressive income tax in a two-period model can emerge from a median voter model (Roberts (1977) and Creedy and Francois (1993), among many others). Spann (1977) considers the political choice between collective consumption and individual consumption. Closely related to the present work is Ye and Yezer (1992) and following papers that examine regulatory pricing of freight movements in spatial monopolies; their results appear to be highly specialized to their application, however, and few general results emerge. A paper which uses very similar techniques to those of this paper is Beard and Thompson (1996) to analyze political choices over the form of two-part tariffs. This excellent paper is quite close in spirit to this work, although focused on a somewhat different set of pricing issues.

Perhaps the most advanced work on relating political economy with economic outcomes is Grossman and Helpman (1995) from the literature on trade. This paper presents a game-theoretic model in which various interest groups “buy” influence (via campaign contributions) with policymakers in their home country, which then enters into either negotiations or a trade war with a second country (whose interest groups also buy influence in their home country). This quite ambitious and insightful model yields important empirical predictions (which the authors do not test) regarding the outcomes of trade wars vs. trade talks and the relevance of in-country political power of interest groups. Theirs is not a decisive-voter model, with the concomitant “winner-take-all” discontinuous payoffs. Rather it focuses on campaign contributions, which in their model result in direct utility to politicians.

Section 2 develops the political economy model of regulation, specifying how the public regulation game is played and the resulting incentives of regulators. In Section 3, the results of this model are presented, including a comparison of political pricing with monopoly

pricing. In Section 4, model hypotheses of regulatory objectives are developed and tested using telephone usage data from 1960 to 1993. Section 5 concludes the paper.

2. The Model

We consider a monopolist² that produces two services, a “mass” service M that everyone is likely to consume and a “specialized” service S that is consumed (perhaps intensely) by part of the population. An example from telephony would be local service as service M and toll service as service S ; an example from information networks would be e-mail and local library text access as service M and full graphics worldwide capability as service S .

Demand Consumers are indexed by q , $0 \leq q \leq 1$, with individual demand functions $q_X(p; q)$.

We assume:

1. $q_X(p_X; q) = I_X(q) \cdot Q_X(p_X)$; individual demand functions are separable in p and q , demands for the two products are independent, and income effects are ignored. Consumer q consumes the fraction $I_X(q)$ of total demand Q_X for service $X=M, S$, so

$$\int_0^1 I_X(q) dq = 1.$$

2. $I_M(q) > 0$, for all q ; everyone consumes the mass service.

The special assumption that each individual’s demand function is a multiple of the aggregate demand function is by no means innocuous. It implies that all consumers with a positive I consume at any price at which anyone consumes. In this formulation, the model is not appropriate for addressing regulatory questions of “universal service” or network externalities.

We use the convention that $I(q) = I_S(q) / I_M(q)$ is an increasing function of q ;³ consumers are indexed according to their ratio of specialized to mass demand.

Consumer q ’s (indirect) utility is:

$$U(p_M, p_S; q) = U_M(p_M; q) + U_S(p_S; q) = \int_{p_M}^{\infty} I_M(q) \cdot Q_M(z) dz + \int_{p_S}^{\infty} I_S(q) \cdot Q_S(z) dz \quad (1)$$

$$\text{with } U'_X = -I_X(q) Q_X(p_X)$$

and aggregate consumer surplus is:

$$W(p_M, p_S) = W_M + W_S = \int_{p_M}^{\infty} Q_M(z) dz + \int_{p_S}^{\infty} Q_S(z) dz, \quad (2)$$

with $W'_X = -Q_X(p_X)$.

Total producer plus consumer surplus is:

$$T = W_M + \Pi_M + W_S + \Pi_S, \quad (3)$$

with $W'_X + \Pi'_X = (p_X - c_X)Q'_X$.

Production We assume that the production technology exhibits constant returns to scale and no economies of scope, thereby abstracting from the problems of ‘natural monopoly’ theory. The cost function is therefore $C(Q_M, Q_S) = c_M \cdot Q_M + c_S \cdot Q_S$, where the marginal cost coefficients are positive constants. The monopolist firm may choose whether or not to produce.

Regulation There is a government which (it is assumed) has chosen to regulate this monopolist. Candidates from each of two parties may run for an elective office of regulator, who then controls the prices charged by the monopolist. These candidates only care about being elected and have no preferences over prices. The candidate receiving a majority of votes wins. Candidates make promises during their election campaign about the level of prices they will permit the monopolist to charge if they are elected. All citizen/consumers vote in this election.

This majority-voting model of regulation should not be taken literally. It is meant to focus attention on price determination through political forces (rather than market forces), abstracting away from the rich institutional structure that characterizes regulation. What is important is that voter support for a particular policy increases the likelihood it will be adopted.

Information and Commitment We assume that there is perfect information: consumers, regulators, and firms know the full model, thereby abstracting away from agency theory. Additionally, we also assume platform promises made by candidate regulators prior to election are binding commitments which the regulators have the power to enforce. Neither of these assumptions reflects the way the world works; our purpose here is to focus attention on the functioning of regulation in a politically-driven context *without* such imperfections, the impacts of which have been studied extensively elsewhere.

There are, of course, many ways in which private parties can influence lawmakers and regulators: campaign contributions, either in cash or in kind, providing information, outright bribery, “get-out-the-vote” campaigns, political education efforts, or smear tactics. In this model, we abstract away from these interesting questions, and focus exclusively on how the political system “ought” to work: informed voters expressing their preferences in elections.

In sum, this stylized model focuses on examining how regulation works if it were to meet its idealized “design specifications”: no lack of voice on the part of customer/citizens, no information asymmetries, no commitment problems, and no rent-seeking behavior. A case can be made that taking into account these real-world complications are likely to reduce the social performance of regulation.⁴

Characterizing Regulated Prices The familiarity of the majority-voting approach to political economy problems suggests that we can forgo the development of a formal model of the game in the interest of brevity. The price outcome $(p_M^V, p_S^V) = \mathbf{p}^V$ of the game is characterized as follows:

- (1) $\Pi(\mathbf{p}^V) \geq 0$; the assumptions of (i) perfect information and (ii) the monopolist does not have to produce imply that citizen/consumers would see candidate platforms that promised unrealistically low prices as “pie in the sky,” and correctly perceive that no output would be produced unless the firm has non-negative prices.
- (2) \mathbf{p}^V is undominated. That is, there exists no price vector $\hat{\mathbf{p}}$ such that (i) $\Pi(\hat{\mathbf{p}}) \geq 0$ and (ii) $\hat{\mathbf{p}} < \mathbf{p}^V$. Clearly, if such a price vector existed, all citizen/consumers would prefer it, so it wins unanimously over \mathbf{p}^V , proving the assertion by contradiction.
- (3) $\Pi(\mathbf{p}^V) = 0$. By continuity of P , this is a necessary condition for \mathbf{p}^V to be undominated. Therefore a candidate has a choice of only one price variable, with the zero profit constraint determining the other, i.e. $p_S = p_S(p_M)$. Not all prices p_M are feasible; only prices in the interval $[p_M^{\min}, p_M^{\Pi}]$ are undominated, where $p_M^{\min} = p_S^{-1}(p_S^{\Pi})$. Within this interval, it is easy to show that a lower mass price requires a higher specialized price: $p'_S < 0$. Hence, individual welfare can be written as a function of the single variable p_M ; e.g. $U(p_M, p_S(p_M); \mathbf{q}) = U(p_M; \mathbf{q})$.
- (4) $U(p_M; \mathbf{q})$ is single-peaked in p_M for all \mathbf{q} , under the assumption that the profit function is concave on the interval $[p_M^{\min}, p_M^{\Pi}]$.
- (5) There exists a unique majority voting equilibrium at the price that maximizes the median voter's \mathbf{q}^V utility: $p_M^V = \arg \max_{p_M} U(p_M; \mathbf{q}^V)$. This is simply the median voter theorem of Downs (1957); results (3) and (4) above are the conditions for which the theorem is true. We refer to this as *the median voter price*.

The median voter price-pair is

$$\mathbf{p}^V = \underset{\mathbf{p}}{\operatorname{argmax}} U(\mathbf{p}; \mathbf{q}^V) \text{ s.t. } \Pi(\mathbf{p}) = 0$$

$$= \left(\frac{c_M}{1 + \frac{\mathbf{m} - I_M(V)}{\mathbf{ne}_M}}, \frac{c_S}{1 + \frac{\mathbf{m} - I_S(V)}{\mathbf{ne}_S}} \right) \quad (4)$$

where μ is the Lagrangian multiplier on the constraint and \mathbf{e}_x is price elasticity of demand and $\mathbf{e}_x = \frac{p_x}{Q_x} \cdot \frac{dQ_x}{dp_x} < 0$. This immediately leads to the following results:

Proposition 1: *If $I_M(\mathbf{q}^V) = I_S(\mathbf{q}^V)$, then the median voter price-pair is*

$$p_M = c_M, \quad p_S = c_S, \quad \text{and} \quad I_M(\mathbf{q}^V) = I_S(\mathbf{q}^V) = \mathbf{m}$$

Proof: With $I_M(\mathbf{q}^V) = I_S(\mathbf{q}^V)$, if both are greater than \mathbf{m} then both prices are less than their respective marginal costs, yielding negative profits, from equation (4). Similarly, if both are less than \mathbf{m} both prices are greater than their respective marginal costs, yielding positive profits, again from equation (4). Thus, only when both are equal to \mathbf{m} $I_M(\mathbf{q}^V) = I_S(\mathbf{q}^V) = \mathbf{m}$, are profits zero. \square

Thus if the median voter has the same proportion of mass and specialized service as does the population as a whole, then the solution will be efficient prices.

However, this is most likely not an accurate representation of such markets. Rather, the median voter is likely to consume a greater fraction of one service over another; our choice of terminology for these services leads us to identify the mass service as of greater use to the median voter than specialized service. The next proposition shows that the median voter's preferred price pair will reflect this consumption allocation favoring mass service.

Proposition 2: *If $I_M(\mathbf{q}^V) > I_S(\mathbf{q}^V)$, then median voter pricing results in*

$$(i) \quad I_M(\mathbf{q}^V) > \mathbf{m} > I_S(\mathbf{q}^V)$$

$$(ii) \quad p_M < c_M \quad \text{and} \quad p_S > c_S.$$

Proof: Obvious from equation (4); in order to assure zero profits, it cannot be the case that both I 's are greater than \mathbf{m} or that both I 's are less than \mathbf{m} \square

Clearly, regulation driven by median voter pricing caters to the consumption preferences of the median voter, extracting monopoly profits from S to subsidize M. The extent to which the regulator can lower p_M depends on the profits extracted from S.

Efficiency of Median Voter Pricing These two propositions merely restates the well-known result that only if the median voter has the same preferences as the mean voter will majority rule result in efficient outcomes. This “well-known result” depends, of course, upon defining efficiency in terms of aggregate surplus. The problems involved with this definition of efficiency are also well-known, in the absence of compensation. If we adopt the more careful but much weaker Pareto criterion for efficiency, then in this model *any* price-pair for which $\Pi(\mathbf{p})=0$ is efficient, since any other price-pair makes one of the consumer groups worse off. In this latter view, regulation results in transfers among groups of citizen/consumers, and normative conclusions regarding their desirability cannot be reached on the basis of a scalar measure such as aggregate surplus. In this paper, we take the somewhat agnostic view that both aggregate surplus and the distribution of surplus are important and worthy of analysis, as evidenced by the results below. However, at the risk of abusing or confusing terminology, we reserve the term “efficient” prices to mean prices which maximize aggregate surplus. In this context, it is only this definition of efficiency that has discriminatory power.

It is no surprise that allocating resources by voting is not efficient, and it is hardly a surprise that voters will opt for subsidies that are in their favor. Even in this case of perfect information and regulators that are perfectly responsive to voters, inefficient outcomes result; hence, “regulatory failure.”

The more interesting question is to compare the efficiency cost of regulatory failure to that of market failure. In the context of this model, we ask how median voter prices compare to monopoly prices, which are

$$p_x^{\Pi} = \frac{c_x}{1 + \frac{1}{e_x}}.$$

The problem of above marginal cost pricing is well understood in the literature and constitute the efficiency case against monopoly. What is not as clear is the effect of *below* marginal cost pricing as occurs in the market for service M under regulation. Can below-marginal cost pricing in the mass market lead to lower aggregate surplus than monopoly pricing? Can prices be driven so low that negative surplus is generated? If we contrast this possibility with the case of monopoly pricing, in which surplus is never negative, we may find that the regulatory cure is worse than the monopoly disease, a problem to which we turn our attention in the next section.

3. Model Results

The principal theoretical results of this paper are (i) median voter pricing can result in total surplus which is less than that achieved under monopoly; (ii) median voter pricing can result in a negative total surplus for the mass service; and (iii) an exogenous increase in the amount

of specialized service consumed by the median voter leads to an increase in both p_M^V and in total surplus, whether this increase comes about through an increase in total demand or from a change in the distribution of demand.

Efficiency In order to address the first two issues, we first note that below cost pricing can only be supported by extracting profit from service S ; the greater the potential profit from S , the lower the price for the mass service M can be. We have from the zero profit constraint

$$\begin{aligned}
 (p_M^V - c_M)Q_M(p_M^V) + (p_S^V - c_S)Q_S(p_S^V) &= 0 \\
 \Rightarrow p_M^V &= c_M + \frac{\Pi_S}{Q_M(p_M^V)} \\
 \Rightarrow \frac{\Pi p_M^V}{\Pi \Pi_S} &= \frac{-1}{Q_M(p_M^V)} < 0.
 \end{aligned} \tag{5}$$

In order to explore the relative inefficiencies of median voter regulation vs. monopoly, we examine an interesting special case: (i) the median voter consumes none of the specialized service: $I_S(\mathbf{q}^V) = 0$; (ii) the demand functions are well-approximated by the semi-log form: $Q_X(p) = a_X \cdot p^{e_X}$; and (iii) we focus on the mass market, assessing efficiency loss as parametric in p_M^V , which is determined largely by profits in the S market, as shown in equation (5).

The first assumption yields the straightforward result that the median voter price for S is the profit-maximizing price, since that yields the lowest possible price for M :

$$I_S(\mathbf{q}^V) = 0 \Rightarrow p_S^V = \frac{c_S}{1 + \frac{1}{e_S}} = p_S^\Pi$$

We can now compare the total surplus achieved by the two institutions:

$$\begin{aligned}
 T^\Pi(p_M^\Pi, p_S^\Pi) &\underset{>}{\lessdot} T^V(p_M^V, p_S^V) \\
 \Rightarrow Q_M(p_M^\Pi) \cdot \left[p_M^\Pi - c_M - \frac{p_M^\Pi}{(e_M + 1)} \right] + Q_S(p_S^\Pi) \cdot \left[p_S^\Pi - c_S - \frac{p_S^\Pi}{(e_S + 1)} \right] &\underset{>}{\lessdot} \\
 Q_M(p_M^V) \cdot \left[p_M^V - c_M - \frac{p_M^V}{(e_M + 1)} \right] + Q_S(p_S^V) \cdot \left[p_S^V - c_S - \frac{p_S^V}{(e_S + 1)} \right] &
 \end{aligned}$$

Rearranging terms yields:

$$Q_M(p_M^\Pi) \cdot \left[p_M^\Pi - c_M \frac{(e_M + 1)}{e_M} \right] \underset{>}{\lessdot} Q_M(p_M^V) \cdot \left[p_M^V - c_M \frac{(e_M + 1)}{e_M} \right]$$

The last step follows from the fact that with $\mathbf{I}_s(\mathbf{q}^V) = \mathbf{0}$, the total surplus from the S market is the same under both institutions, so the surplus comparison depends only upon p_M^V .

By taking the semi-log approximation of the demand curves, elasticities e_M and e_s are held constant, and therefore can be treated as exogenous parameters. With this approximation, the surplus comparison is:

$$T_M^V \stackrel{\geq}{<} T_M^\Pi \Rightarrow \left(\frac{p_M^V}{c_M}\right)^{e_M} \left[\frac{p_M^V}{c_M} - \frac{e_M + 1}{e_M}\right] \stackrel{\geq}{<} \left(\frac{e_M}{e_M + 1}\right)^{e_M} \left[\frac{e_M}{e_M + 1} - \frac{e_M + 1}{e_M}\right];$$

Defining the relative price as $\hat{p}_M^V = \frac{p_M^V}{c_M}$, we have

$$T_M^V \stackrel{\geq}{<} T_M^\Pi \Rightarrow (\hat{p}_M^V)^{e_M} \left[\hat{p}_M^V - \frac{e_M + 1}{e_M}\right] \stackrel{\geq}{<} \left(\frac{e_M}{e_M + 1}\right)^{e_M} \left[\frac{e_M}{e_M + 1} - \frac{e_M + 1}{e_M}\right], \text{ and} \quad (6)$$

$$T_M^V \stackrel{\geq}{<} 0 \Leftrightarrow \hat{p}_M^V \stackrel{\geq}{<} \frac{e_M + 1}{e_M}. \quad (7)$$

The right-hand side of (6) is always positive, so the set of relative prices \hat{p}_M^V with positive mass surplus is larger than the set of prices in which total surplus is greater with median voter regulation over monopoly.

Denote by $v(e_M)$ the relative price at which (6) holds at equality and $z(e_M)$ the relative price at which (7) holds at equality. Then these two equations can be represented graphically below.

Relative Efficiency of Median-Voter Regulation vs. Unregulated Monopoly

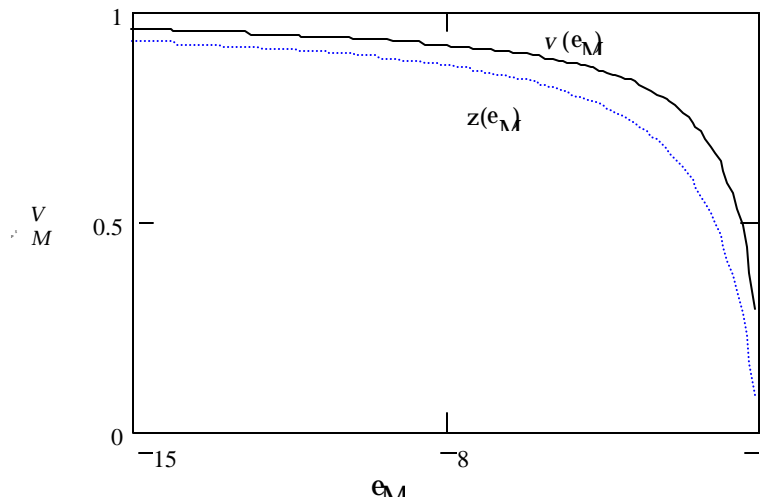


Figure 1

This is captured in the following Proposition:

Proposition 3: *Assuming (i) semi-log demand and (ii) the median voter consumes no specialized service, then median voter pricing may lead to*

- *lower total surplus than monopoly pricing;*
- *negative total mass service surplus,*

depending upon profits available from S and the elasticity of demand of M .

Proof: See Figure 1. \square

The intuition behind Figure 1 is straightforward. A higher valued specialized service leads to greater extraction of profit (and greater surplus loss) in order to subsidize lower prices for mass service, moving down the vertical axis of the figure. A more elastic mass service leads to greater quantity response to lower prices, and so greater consumption at prices below cost, moving to the left on the horizontal axis. Both a higher valued specialized service and a more elastic mass service lead to greater inefficiencies, and a greater likelihood that regulation performs worse than monopoly or even results in a negative total mass service surplus.

Figure 1 also has important policy implications. If the mass service has fairly inelastic demand, then the price relative \hat{p}_M^V can be quite low and still have median voter prices superior to monopoly prices. However, even a small increase in $-e_M$ greatly narrows the scope of median voter regulation to outperform monopoly. In the case of telephone service, the mass service is access and local calling, which has a very low estimated elasticity. This would suggest the long-standing subsidy from toll service to local, while it had efficiency costs, was still superior to monopoly. However, for new information services, this need not be the case. For example, if e-mail and text access to local information providers is considered the mass service, it is as likely as not to be reasonably price-sensitive. In this case, if regulation ended up subsidizing a highly price-sensitive service, regulation could be less efficient than pure monopoly, or even generate negative surplus from the mass service.

Rent Distribution It is obvious that in the special case in which the median voter consumes none of the specialized service, regulation simply re-distributes the rents extracted from the consumers of S from the monopoly to the consumers of M . The previous example shows that this may result in a reduction in total surplus, but that example does not address the equally important question of the *distribution* of the surplus.

There are two approaches to understanding rent distribution: the first, more classical welfare economics approach is to note that using aggregate surplus as an efficiency measure is making an implicit choice regarding a social welfare function, in which all consumers are equally weighted. Suppose that the welfare weights of mass service consumers and specialized service consumers were different; would that change the implications of Figure 1? A moment's reflection should convince the reader that using *weighted* aggregate surplus, with

differing weights for mass and specialized consumers will shift the *location* of the curves in Figure 1, but will not alter the basic structure of the model. Placing more weight on mass service shifts the curves down and to the left, while placing more weight on specialized service shifts the curves up and to the right. More precisely, for any mass vs. specialized weights, there exists an unbounded region in Figure 1 in which weighted aggregate surplus is reduced under regulation as compared to monopoly. For example, even if the surplus from specialized service has a relatively small weight compared to mass service, it could be that the specialized service is so important to its consumers that there is a huge surplus lost by them outweighs their relatively low social weight. In Figure 1, a huge (unweighted) specialized surplus translates to a very low (possibly negative) relative price for the mass service.

The second approach to understanding rent distribution is simply to identify which players get what rents. It is to this that we now turn. Our next example demonstrates how surplus is divided up among M consumers, S consumers, and the monopolist F , still under the assumption of $I^V = 0$. The distribution of rents depends upon (i) the elasticities e_M and e_S , and (ii) the relative magnitudes of the surplus available from M and S . For concreteness, we use $e_M = -1.2$ and $e_S = -5$ in this example, and we normalize the total surplus available with competition to be unity (from equation (2), $W_M + W_S = 1$). The interpretation of greater W_S is that the specialized service is of greater value to its consumers relative to the consumption value of service M .

In Figure 2 below, the surplus frontiers for groups M and S , for competition (as the benchmark) and for both median voter pricing and monopoly pricing. The heavy black line with slope -1 is simply the surplus achievable under competition, defined to satisfy $W_M + W_S = 1$. The thin black line is the frontier with median voter pricing. It lies almost everywhere inside the competitive frontier; each S consumer achieves only about 40% of the surplus a competitive regime would yield. The thin shaded line represents the frontier of direct surplus each group gets under monopoly pricing. Clearly, this lies inside the median voter pricing frontier, since both groups now face monopoly prices. Under this regime, each S consumer obtains 70% of the surplus a competitive regime would yield (and each S consumer again achieves 40%, as above). However, this does not take account of the profits of the monopolist. In order to include these profits, we assume that each group owns shares of the monopolist and thus receives a share of the profits, either as dividends or prospective growth in earnings. For illustrative purposes, we assume that profits are split among the two groups in the same proportion as the competitive surplus.⁵ This yields the “Profit Max with Distribution” frontier, which crosses the median voter frontier, and lies outside it for larger values of W_S (as implied by Figure 1).

To focus more sharply on distribution, the plotted points (C, V, P) show the surplus distribution for each regime when the competitive surplus is split equally: $W_S = W_M = 0.5$, located at point C. V is the distribution of surplus for this example with median voter pricing and P is the surplus distribution with monopoly pricing (assuming profits shared in proportion to competitive surplus share). Clearly, service M customers prefer median voting

to monopoly, and even to competition. Service S consumers, on the other hand, prefer monopoly to median voting, but not to competition.

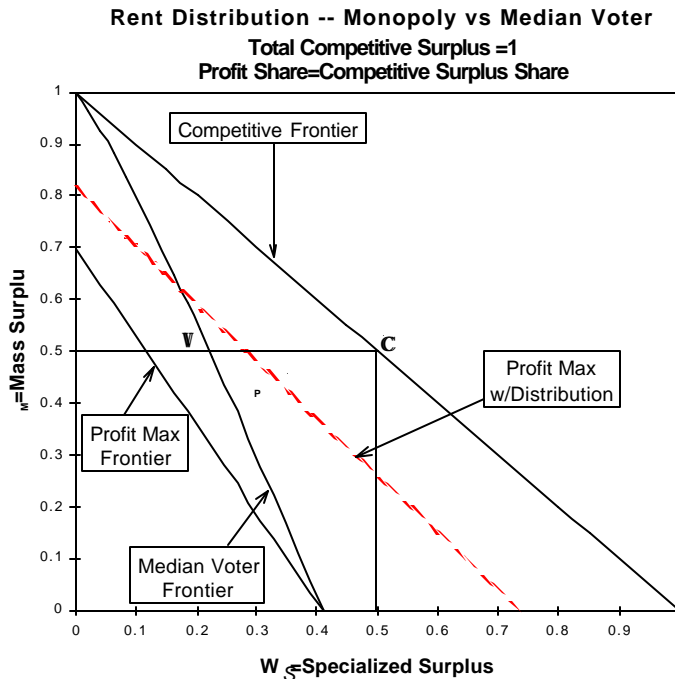


Figure 2

Changing Median Voter Consumption The Figure 1 and Figure 2 examples illustrate starkly the potential negative efficiency effects if the median voter consumes none of the specialized service. However, Proposition 1 portrays a more optimistic picture, in which efficiency is achieved when the median voter consumes equal fractions of both services. We next analyze the effect of increasing the share of service S by the median voter on total surplus. We focus on the *relative* distribution of toll demand for the median voter, defined as $I^V = I_S(q^V) / I_M(q^V)$. Welfare for the median voter can be re-scaled to be $U(p_M; q^V) = W_M(p_M) + I^V W_S(p_S(p_M))$.

Proposition 4: Both p_M and total surplus increase as I^V increases, for $0 < I^V < 1$.

Proof: See Appendix.□

The interpretation is straightforward: the closer is the demand pattern of the median voter to the mean voter (and thus population as a whole), the greater is the total surplus that results from maximizing the median voter's utility. This proposition strengthens and extends our previous results to show that both aggregate surplus and price of the mass service are monotonic in I^V .

The last proposition shows that exogenous increases in the amount of the specialized service consumed by the median voter lead to more efficient pricing. This relatively straightforward model result yields a very strong prediction regarding pricing behavior in telecommunications over the past 35 years. It is widely believed that toll telephone calls, considered a rare luxury in the 1950's, are now widely demanded by most consumers. Proposition (4) would then imply that initially, toll service would subsidize local service, but that as the demand pattern changed over this period, the subsidy would be reduced: local prices would increase and toll prices would decrease. It is also widely believed that the policy changes of the 1970's and 1980's, which led to the rate restructuring of the 1980's and 1990's, have indeed moved toll and local prices closer to their respective costs. These results, therefore, demonstrate the link between the two, suggesting that changing demand patterns of the median voter (and not efficiency considerations) have led to increased competition and changing rates. It is to this empirical issue to which we now turn.

4. Empirical Results

The substantial changes which have occurred in the telecommunications industry over the past two decades constitute a natural experiment for testing this model. Conventional wisdom in the field is that for many years, toll service provided a large subsidy to local service. The AT&T divestiture constituted a significant shift away from regulated monopoly which supported this⁶ subsidy, toward a more competitive model which will not support subsidies. Further, the data (as we shall see below) support this conventional wisdom. Surprisingly, economists have not attempted to explain why this important and fundamental shift occurred at this particular time. The model developed in this paper suggests a place to look for this explanation: if the preferences of the median voter changed significantly toward toll over this period, then the model predicts that the political system will respond by adopting a competitive regime that would favor reductions in the previous subsidies.

The hypothesis, then, is that shifts in the preferences of the median voter toward toll service are closely related (with appropriate lags) to shifts in toll and local prices produced by the recent more competitive market structure.⁷ In order to test this hypothesis, we estimate the model⁸ using toll and local telephone price and cost data, as well as data on the distribution of toll usage across the population, from 1960 to 1993.⁹

The overall strategy to test this hypothesis is

1. Derive equations for price-cost margins for each service, based on the model developed above.
2. Construct series that represent prices, costs, revenues, and median voter preferences from actual telephone data.

3. Use the equations, the data, and constructed series to predict the price-cost margins.
4. Regress actual margins against predicted margins, using lags of order 0 through 10.

The hypothesis is accepted or rejected based on the t -statistics and R^2 of the regression of the final step.

Predictive Model. The model to be estimated consists of the first-order condition for maximization of the median voter's utility plus the budget constraint (substituting T (toll) for the S (specialized service) and L (local) for M):

$$U'(p_L, p_T; 0.5) = 0 \Leftrightarrow I(0.5) = -\frac{Q_L}{Q_T p_T'} = \frac{1 + \frac{p_T - c_T}{p_T} \mathbf{e}_T}{1 + \frac{p_L - c_L}{p_L} \mathbf{e}_L},$$

$$(p_T - c_T)Q_T + (p_L - c_L)Q_L = 0.$$

where the last equality in the first equation can be obtained by noting that

$$p_T' = -\frac{\frac{\partial U}{\partial p_M}}{\frac{\partial U}{\partial p_S}} = -\frac{Q_M (1 + \frac{p_M - c_M}{p_M} \mathbf{e}_M)}{Q_S (1 + \frac{p_S - c_S}{p_S} \mathbf{e}_S)}. \text{ It is somewhat more convenient to use margins } m_x \text{ rather}$$

than prices, so the relevant equations are

$$\begin{aligned} I(0.5) &= \frac{1 + m_T \mathbf{e}_T}{1 + m_L \mathbf{e}_L} \\ 0 &= m_T R_T + m_L R_L \end{aligned} \tag{8}$$

The data required to estimate this model consists of the distributional information, prices, unit costs, quantities, and elasticities.

Distributions of Toll and Local Usage. Since local usage typically carried a zero price for most consumers during most of this period, and telephone penetration was relatively constant at over 90% during this period, we assume that local service was uniformly distributed over the relevant population. For toll service, we note that our assumption that the distribution of demand does not depend upon price plays a key role in this empirical analysis, in that the demand distribution can be recovered from revenue distribution. We examine two data sources:

- (i) toll revenues by income quintile,¹⁰ annual, 1984-1993 (Lande, 1994);
- (ii) toll revenues by income percentiles, 1972-73 (Bureau of Labor Statistics, 1974) and 1960-61 (Bureau of Labor Statistics, 1963).

For each of these twelve years, the one-parameter cdf \mathbf{q}^{a+1} was estimated. For this family of distributions, the uniform corresponds to $\mathbf{a} = 0$; the larger is \mathbf{a} , the more skewed the

distribution is toward higher q , and therefore the more specialized is the service. Thus, a declining over time implies that toll service is becoming more of a mass service. The table below shows the coefficients of each year's regression:

Estimated Toll Distribution Parameter α

Year	a	Year	a
1960	0.882	1988	0.408
1972	0.694	1989	0.371
1984	0.356	1990	0.342
1985	0.387	1991	0.338
1986	0.382	1992	0.338
1987	0.387	1993	0.370

Table 1

For each year, the regression coefficient had a t -statistics in excess of 5 and an $R^2 \geq 0.99$. A time trend was fit to these coefficients, yielding

$$\hat{a}_t = 1.897 - 0.172 \cdot t, \quad t = 60, 72, \dots, 93, \quad (9)$$

with both coefficients having a t -statistic in excess of 11, and an adjusted $R^2 = 0.927$ and $F = 140.81$. It should be noted that although the linear fit is quite good, it appears that the downward trend seemed to mitigate during the period of the 1980s and early 1990s. This suggests that the principal changes in toll distribution occurred prior to this period.

Figure 3 below shows the cumulative distribution functions, both estimated and empirical, for toll usage in 1960 and in 1993, showing the trend toward mass service.

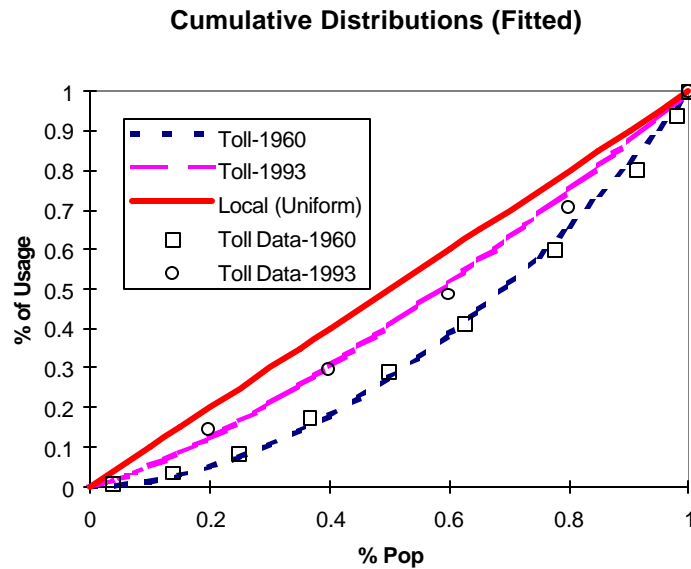


Figure 3

These results are used to provide estimates of the preferences of the median voter, for 1960-1993: $\hat{I}_t = (\hat{a}_t + 1) \cdot (0.5)^{\hat{a}_t}$.

Quantities and elasticities. The quantities of toll and local (number of calls) are taken from *Statistics of the Common Carriers* (1960-1994). Toll and local elasticities are assumed constant over this period, following Taylor (1980) and Taylor (1994). We assume $e_L = -0.2$, $e_T = -1.0$, based on these estimates.

Prices and unit costs. The consumer price index for telephone consists of an overall price index, available from 1960 to 1993, and separate indices for local and toll. Unfortunately, the separate indices are available only from 1978 to 1993. In order to estimate the separate indices from 1960 to 1977, it was noted that the relationship between the separate indices and the overall index was very stable from 1978 to 1983 (the period just prior to the AT&T divestiture); therefore, these relationships were estimated using a linear model (t -statistics over 80, $R^2 \geq 0.93$ for both local and toll) over this time period, and then backcast for the period 1960-1977 based on the overall telephone price index. The price series used, then, consists of actuals from 1978-1993 and backcast estimates from 1960-1977.

Unit cost data in the telecommunications industry are virtually non-existent. It was therefore necessary to derive cost numbers based on two assumptions: (i) during the period prior to the AT&T divestiture, toll prices were estimated¹¹ to be about two to three times the marginal cost of toll; (ii) assuming zero profits, the quantity-weighted unit costs must equal the overall price index. These assumptions imply relationships between the overall price index and the unit costs for local and toll, which we use to construct a unit cost series for the time period. The results of the price and unit cost derivations are shown in Figure 4:

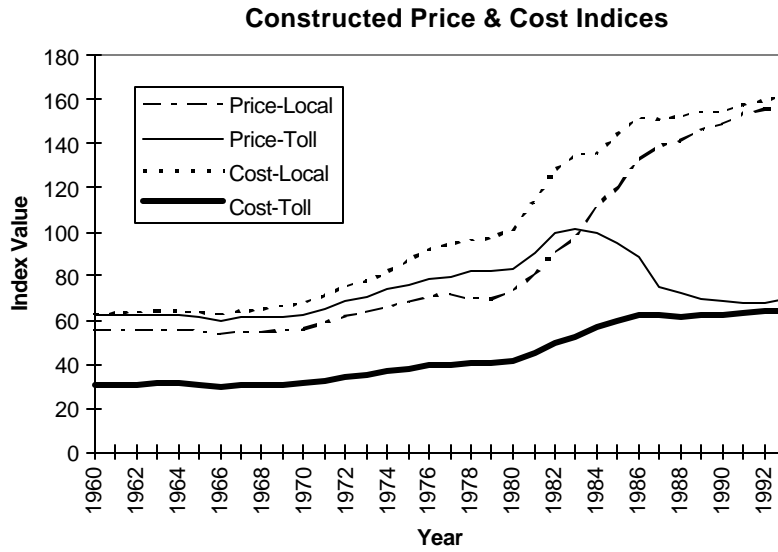


Figure 4

The price index series from 1978 onward (actual data) shows the extraordinary change in pricing policy that followed the AT&T divestiture, with toll prices declining and local prices rising. If the unit cost numbers are credible, this chart suggests that toll and local prices in the 1990's are rather close to their unit costs.

Predicted Margins and Estimation. Equations (8) can be rearranged to yield predicted toll and local margins for each year, based on the above data:

$$\tilde{m}_L^t = -\frac{1 - \hat{I}_t}{0.2 \cdot \hat{I}_t + \frac{R_L}{R_T}} \quad (10)$$

$$\tilde{m}_T = -\tilde{m}_L \cdot \frac{R_L}{R_T}$$

The predicted margins are based on both the market revenues and the preferences of the median voter. Recognizing that political influence on pricing may not be instantaneous, we estimate a lagged model of actual margins vs. predicted margins:

$$m_L = \mathbf{b}_L + \sum_{t=0}^{10} \mathbf{b}_t \tilde{m}_L(-t) + e_L \quad (11)$$

$$m_T = \mathbf{b}_T + \sum_{t=0}^{10} \mathbf{b}_t \tilde{m}_T(-t) + e_T$$

Since whatever causes political lags in setting local prices should also cause lags in setting toll prices, the coefficients of the lag terms are constrained to be equal. Further, we would also expect that the error terms of the two equations would be correlated, because the regulatory

and market decisions in the two markets are linked. Therefore, system (11) was estimated using seemingly unrelated regression.

Conducting the unit root test on each of the two series m_L and m_T suggest that neither series is stationary. Taking first differences improved the situation, but non-stationarity cannot be rejected. However, taking second differences does yield series for which non-stationarity can be strongly rejected. Consequently, seemingly unrelated regressions were run on the levels, the first differences, and the second differences, applied on both sides of (11). The results of all three regressions are given below:

Lagged Regression Results - Model vs. Actual

	Level Coefficient t	(St Dev)	First Diff Coefficient	(St Dev)	Second Diff Coefficient	(St Dev)
Toll Const	-0.414	(0.184)	0.235	(0.100)	0.0075	(0.017)
Local Const	0.687	(0.094)	-0.025	(0.071)	0.0081	(0.015)
Lag = 0	-184.965	(19.506)	-177.473	(30.934)	-177.013	(28.398)
Lag = 4	125.893	(32.513)	-25.271	(93.480)	-272.188	(84.125)
Lag = 6	316.168	(36.830)	106.186	(33.723)	99.677	(33.060)
Lag = 7	-308.409	(35.634)	82.671	(118.822)	201.469	(96.929)
Lag = 8	109.744	(40.961)	-65.949	(99.882)	-9.432	(78.480)
Lag = 10	-72.617	(33.680)	109.558	(46.709)	169.940	(82.948)
Toll Adj R^2	0.863		0.956976		0.972406	
Local Adj R^2	0.881		0.948847		0.941263	

Table 2

The lag coefficients that are shown in bold and italic are significant in each of the regressions.

Each method of estimation leads to a very high R^2 and adjusted R^2 , suggesting that the political model explains almost all the observed variation in toll and local price/cost margins. Most surprising is that differencing the estimation equation leads to a higher R^2 , and differencing it twice leads to even higher R^2 , which strongly suggests the stability of the relationship.

Closer examination reveals that the model does not have the strong predictive power that the t -statistics and R^2 suggests, for several reasons. (i) The sum of the lag coefficients for the second difference estimation is 12.453, and over 20 if the insignificant coefficient is dropped. On net, the magnitude of the actual margins (m) is over twelve times the magnitude of the predicted margins (\tilde{m}), though the theory suggests they should be equal. (ii) There are very significant swings in the lag coefficients, from a positive 200 to a negative 272. One might expect a smooth decay process, yet there is no obvious trend in the coefficient estimates.

These swings are not explained by the theory, and for which no obvious explanation comes to mind.

Thus, the regression results, which imply an impressive predictive power for the model, should be tempered by the unexplained magnitude and variation among the coefficients. It must also be recalled that many of the numbers used to derive the predicted margins are actually constructs rather than actual numbers, and these constructs are necessarily built upon somewhat patchy data, suggesting further caution in interpreting the strong regression results.

Nevertheless, it appears clear that the hypothesis that the political model explains the substantial variations in toll and local prices (and therefore price/cost margins) that have occurred in telecommunications is confirmed by the empirical analysis.

5. Conclusions

In this paper, a *political economy model of regulation* is developed, based on a median voter model of pricing two services of a regulated monopolist. This model is in sharp contrast to the dominant agency paradigm of regulatory economics, in that a political process takes center stage in determining economic outcomes, rather than asymmetric information (or natural monopoly).

We assume an idealized model of regulation, in which there are no information asymmetries, no bribery, no inefficiencies, and regulators are completely responsive to the wishes of the voters. The model may be viewed as an extreme case of “civics class” politics. In this model, specialized services, consumed by only some of the voting population, subsidize mass services, reflecting the preferences of the median voter. We compare this idealized regulation to unregulated monopoly, and find that for a broad range of parameter values, median voter regulation is welfare-inferior to monopoly, and may lead to negative surplus for the mass service. As the specialized service becomes more widely consumed, the subsidy from specialized to mass decreases: specialized service price decreases and mass service price increases.

The very substantial price changes which occurred in telecommunications attendant to the AT&T divestiture were seen by many as wiping out the subsidy structure which had characterized the industry since before World War II. If this change was a response to changing preferences of the median voter, then this event constitutes a natural experiment against which to test the model. Using the rather limited data available, the hypothesis that the model explained the price changes as a result of changes in the distribution of toll demand was tested; the hypothesis was strongly confirmed.

We make no claim for the realism of either the economics or the politics of the model. Surely the median voter model is quite primitive, ignoring institutions, multi-issue politics, and agenda-setting. Further, the economic model of constant marginal costs and no fixed costs ignores important determinants of telecommunications technology. Nevertheless, bringing the two ideas together into a political economy model appears to have substantial explanatory power of an empirical phenomenon in a major US industry which hitherto has been left unexplained by economists.

-- Appendix --

Proof of Proposition 4:

The first-order condition for a maximum is

$$W'_M + \mathbf{I}^V \cdot W'_S p'_S = 0, \quad (12)$$

and the second-order condition is

$$W''_M + \mathbf{I}^V \cdot [W''_S \cdot (p'_S)^2 + W'_S p''_S] < 0. \quad (13)$$

Total differentiation of (12) yields

$$\frac{dp_M^V}{d\mathbf{I}^V} = -\frac{W'_S p'_S}{W''_M + \mathbf{I}^V [W''_S (p'_S)^2 + W'_S p''_S]} > 0. \quad (14)$$

Each term in the numerator is negative, and the denominator is negative, from (13), so the expression can be signed, so that the price for service M is monotonic increasing in \mathbf{I}^V .

The derivative of total surplus is

$$T' = (p_M - c_M) Q'_M + (p_S - c_S) Q'_S p'_S \stackrel{\geq}{>} 0 \text{ as } p_M \stackrel{\leq}{>} c_M. \quad (15)$$

Provided $\mathbf{I}^V < 1$, $p_M < c_M$, and surplus is increasing in p_M ; therefore, combining (14) and (15), we have that welfare is increasing in \mathbf{I}^V . \square

-- Notes --

¹ The Virginia School, associated with Buchanan and Tullock, takes an even less rosy view of political influence, claiming that potential rents are dissipated by rent-seeking behavior on the part of constituencies. Little of this literature is focused directly on regulation.

² To keep the analysis uncluttered, we do not specify the source of the monopolist's market power. It is closest to the spirit of the analysis to think of the monopolist as owning an exclusive franchise.

³ This condition need not uniquely determine the ordering of the index. If we further assume that $I'_S \geq 0, I'_M < 0$ then the ordering is unique.

⁴ Becker (1983) and others of the Chicago School would argue that rent-seeking on the part of interested parties in the political marketplace leads (under special assumptions) to efficient redistribution, and therefore this activity is welfare-enhancing. This is not a universally-held view, but since it is not the point of this paper, we need make no judgment on this issue.

⁵ Varying the assumption of how profits are shared among the two groups does not alter the result that the two frontiers cross. However, note that we assume implicitly that profits are shared equally *within* each group, in order to simplify the exposition. Further, since this analysis is for illustrative purposes only, voter/consumers do not take the profit distribution into account when voting on prices.

⁶ As well as a number of other subsidies, such as from urban-suburban users to rural users, business to residential users, and Bell companies to independent companies. While these subsidies were (and are) politically important, the most economically important subsidy was that from toll to local, and it is this subsidy that is the focus of this paper.

⁷ Some analysts dispute that the shifts in toll and local prices were produced by increased competition. Taylor and Taylor (1993) assert that the extensive rate rebalancing that occurred in the 1980's was due principally to aggressive reductions by the FCC in carrier access charges, followed by aggressive reductions in AT&T rates, again at the behest of the FCC. Whether regulators/legislators brought about this rebalancing directly or indirectly via competition does not matter to our hypothesis. The rebalancing occurred as a result of some aggressive public policy action.

⁸ It is as obvious to the author as it is the reader that the assumptions of the model, especially that of constant returns to scale, are gross oversimplifications of telecommunications economics. This analysis is intended only as a first-order analysis of the model, designed merely to assess the relevance of this form of political economy modeling to real-world situations.

⁹ The relative paucity of the data required that various estimation methods be employed to "backcast" certain information which was not available over the sample period, which involves the use of assumptions and approximations which appear reasonable to the author but perhaps not to the reader.

¹⁰ The use of income as the basis of the underlying distribution of usage is an approximation forced upon us by what data is available. While there may be reason to suspect that toll usage and income may be weakly correlated, it is highly unlikely to be a perfect correlation, nor is it likely that the correlation, if it exists, is stationary.

¹¹ See Rohlfs (1979) for one of the few extant careful price and unit cost analyses.

-- References --

- Baumol, W. and D. Bradford, 1970, Optimal departures from marginal cost pricing, *American Economic Review* 60, 265-83.
- Baumol, W., J. Panzar, and R. Willig, 1982, *Contestable Markets and the Theory of Industry Structure* (Harcourt Brace: Jovanovich San Diego).
- Beard, T., and H. Thompson, 1996, "Efficient vs. 'popular' tariffs for regulated monopolies," *J. Business*, 69, 75-87.
- Becker, Gary S., A theory of competition among pressure groups for political influence, *Quarterly Journal of Economics*, XCVIII, 371-400.
- Bureau of Labor Statistics, 1963, *Consumer Expenditure Survey 1960-61*, Table 29A, Washington, DC: U.S. Department of Labor.
- _____, 1974, *Consumer Expenditure Survey, 1972-73*, Table 1, Washington, DC: U.S. Department of Labor.
- Creedy, J. and P. Francois, 1993, Voting over income tax progression in a two-period model, *Journal of Public Economics* 50, 291-298
- Downs, A., 1957, *Economic Theory of Democracy* (HarperCollins: New York).
- Grossman, G. and E. Helpman, 1995, Trade wars and trade talks, *Journal of Political Economy* 104, 675-708.
- Laffont, J-J., 1994, The new economics of regulation ten years after, *Econometrica* 62, 507-537.
- _____, and J. Tirole, 1993, *A Theory of Incentives in Procurement and Regulation* (MIT Press: Cambridge, MA.).
- Lande, J., 1994, *The Reference Book: Rates, Price Indexes, and Household Expenditures for Telephone Service* (Industry Analysis Division, Common Carrier Bureau, Federal Communications Commission : Washington, DC).
- Peltzman, S., 1980, The growth of government, *Journal of Law & Economics* 23, 209-87.
- Roberts, K.W.S., 1977, Voting over income tax schedules, *Journal of Public Economics* 34, 329-340.
- Rohlf, J., 1979, Economically efficient bell-system pricing, Bell Laboratories Economic Discussion Paper #138.

Spann, R., 1974, Collective Consumption of Private Goods, *Public Choice*, 20 (Winter), 63-81.

Statistics of the Common Carriers, 1960-1994, (Federal Communications Commission : Washington, DC).

Stigler, G. (ed.), 1988, *Chicago Studies in Political Economy* (University of Chicago Press: Chicago, IL).

Taylor, L., 1994, *Telecommunications Demand in Theory and Practice* (Kluwer Academic Publishers : Norwell, MA).

_____, 1980, *Telecommunications Demand* (Ballinger Publishing Co.:Cambridge, MA).

Taylor, W.. and _____, 1993, Postdivestiture long distance competition in the United States, *American Economic Review* 83, 185-190.

Vogelsang, I. and J. Finsinger, 1979, A regulatory adjustment process for optimal pricing of multiproduct monopolies, *Bell Journal of Economics* 10, 157-171.

Ye, M. and A. Yezer, 1992, Voting, spatial monopoly, and spatial price regulation, *Economic Inquiry* 30, 29-39.