<u>INFRASTRUCTURE COSTS AND CONTESTABILITY THEORY(1)</u>

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1. INTRODUCTION

Deregulation of the transportation industries has recently created a special set of infrastructure pricing problems often labeled "competitive access," or the "bottleneck problem." Competitive access or network-interconnect problems occur in industries such as railroads, gas pipelines, and telecommunications because elements of service in infrastructure networks are sometimes characterized by economies of scale and barriers to entry, at least in the short run. Effective competition thus is not always immediately possible across the entire spectrum of services offered in the regulated industry (Meyer and Tye, 1985, 1988).

A commonly proposed solution is to design policies that enhance competition wherever possible by giving all competitors access to the bottleneck portions of the infrastructure on roughly equal terms to prevent vertical foreclosures of competition(2) across the network. Typical examples include mandatory interconnections with competitors, line-of-business restrictions, divestiture (such as the Bell Operating Companies from AT&T), or "unbundling" (such as the transportation and energy components of price in natural gas markets). Elsewhere regulations have been designed to give all competitors equal access to marketing channels, such as attempts to achieve unbiased computer reservations systems in the airline industry (Levine, 1987). Other examples involve the award of trackage rights over a merged rail carrier's system to restore competition ostensibly eliminated as a consequence of merger. These approaches to infrastructure access pricing share a common feature: regulators have tried to establish reasonable terms of access to the remaining limited access portions of the network -- so that effective competition may be enhanced in the rest of the system.

A series of articles has recently appeared in the economic literature reporting apparently successful efforts to apply the theory of "contestable markets"(3) to practical problems of providing competitive access to infra-structure. The new theory has been recently employed as an imprimatur for a remarkable set of recommendations for public policy in industries undergoing a transition to deregulation, most particularly regulated transportation industries.(4) These applications told regulators that they should act as "a surrogate for competition unimpeded by entry barriers" (Baumol and Willig, 1983a, p. 23) and that the theory of contestable markets provides a "competi-tive market model" for a regime of partially regulated multiproduct firms operating under scale economies and competing directly with one another at prices in excess of marginal costs (Willig and Baumol, 1987). The precept guiding these applications was the notion of "a perfectly contestable market, where, under certain entry and exit conditions, the presence of potential competition can generate performance that maximizes market performance"

(Morrison and Winston, 1987, p. 54). The stated task of regulators in the transition to deregulation was to remove impediments to movement toward the new welfare ideal of perfect contestability.

An examination of these recent applications of the theory (i) reveals insights into unresolved theoretical problems with the theory of contestable markets, (ii) illustrates paradoxes when applying the theory as a "standard of welfare-maximizing structure and behavior" (Baumol, 1982, p. 2, and Baumol and Willig, 1986) as regulators seek to act as "surrogates for competition," and (iii) explains the puzzling economic policy recommendations that have actually urged movements away from greater contestability to achieve projected welfare gains. The perception of major sustainability problems in markets approaching perfect contestability explains the surprising fact that applications of the theory often conclude that departures away from contestability are, in practice, welfare enhancing. These policy recommendations represent a significant reversal of the prior conclusion that the theory supported the elimination of frictions on contestability in industries undergoing a transition to deregulation. These perceived sustainability problems also pose questions as to how contestability analysis can achieve its objective of replacing perfectly competitive markets as the standard of welfare-maximizing structure and behavior.

2. THE RELEVANT THEORY OF PERFECT CONTESTABILITY

2.1 Perfect contestability

Contestability via hit-and-run entry requires the following key conditions to be satisfied:
  1) No barriers to entry: there must be no costs borne by the new entrant that are also not borne by the incumbent.
  2) No barriers to exit: the new entrant can engage in hit-and-run entry because it can exit at no cost, i.e., there are no "sunk costs."
  3) Asymmetric time lags: the time lag in the incumbent's price response to entry must be greater than the time lag in the entrant's ability to exit. As is widely recognized, the key to hit-and-run entry is that the new entrant must be able to win "the race between entry and retaliatory measures by incumbents" (Bailey and Baumol, 1984). It must be able to enter the market, enjoy profits at prices above competitive levels for a brief period of time, and exit at no cost before the incumbent can retaliate.($\underline{5}$)

Two additional important concepts are that a "feasible contestable industry configuration" requires that each firm be "viable" (total revenues equal or exceed total costs), and that the firm's choice of prices and outputs be "sustainable" (there are no profitable opportunities for hit-and-run entry by an entrant producing any subset of the incumbent's output).($\underline{6}$) Unlike the lagged price response assumed for incumbent firms, perfect information and instantaneous response are assumed to characterize customers' responses to such entry.

The "most dramatic results" of contestability (Bailey, 1981) are those of a "contestable monopolist." A firm operating under a regime of "fixed" costs (costs that are invariant to changes in unit of output per time period) but not "sunk" costs (costs that cannot be recouped after exit from

a market) would enjoy the security of costless exit and the lowest cost of any potential market structure, but the threat of hit-and-run entry would preclude excess profits. Indeed, since arbitrary subsets of exchanges in a competitive market are contestable markets (Baumol, Panzar, and Willig, 1983), it would appear that the chief distinct contribution of the contestability theory would be that of a contestable monopolist.(7)

The theory of contestable markets is offered as a new "standard of welfare-maximizing structure and behavior" (Baumol, 1982, p. 2 and Baumol and Willig, 1986). More specifically, such markets are said to be characterized by the following welfare properties: (i) no excess profits can be earned; (ii) no inefficient firm can survive; (iii) no cross subsidies can persist; and (iv) predatory pricing must be unprofitable (Baumol, 1983a, p. 42). The last two requirements may provide a fairly permissive constraint on the choice set of prices available to the contestable firm. However, where there are multiple incumbents in the market, sustainable prices must equal marginal cost. Only if the contestable firm is a monopolist is Ramsey Pricing above marginal cost sustainable against entry (Baumol, 1982).

Critics of the new theory have focused their attention, as is proper when evaluating a new theory that purports to be "no less than a unifying theory as a foundation for the analysis of industrial organization" (Baumol, 1982, p. 15), on the theory itself. Because its assumptions on entry and exit seem so implausible, most of the criticisms of the theory have focused on the assumptions required to achieve market forms characterized by hit-and-run entry. Schwartz and Reynolds (1983, p. 490), for example, characterize these as "grossly unrealistic." Additional evaluation of contestability theory has dwelled on the unreasonableness of the entry deterrence and post-entry oligopolistic aspects of the assumptions behind hit-and-run entry. (See Spence, 1983, and Brock, 1983, p. 1062, who refers to "unpalatable hidden assumptions.") William G. Shepherd (1984, 1986) reviews the theory in the context of the field of industrial organization. He concludes that the theory of "ultra-free entry," to use his preferred terminology, is a polar case without substantial interest as a general theory of market structures, is internally inconsistent, is inconsistent with a vast body of empirical evidence, and is as yet empty of testable hypotheses.

Contestability theory reopens some of the oldest issues in microeconomics, including ones that are generally thought to be long-settled. Mainstream economic theory assumes a spectrum of competition beginning with Marshall's perfect competitor that prices at marginal cost. At the other end of the spectrum was the (possibly price discriminating) monopolist, who charged prices above marginal costs, associated with Baumol and Bradford (1970), but going back to Ramsey, Boiteux, and Dupuit and others. This monopolist was required to price above marginal cost to achieve firm viability but in the regulated setting was encouraged by regulators to choose the Ramsey optimal price vector. As long as there was a restriction on perfect competition, it was thought that Ramsey Pricing would at least minimize the costs imposed by the departure from the world of marginal cost pricing. If there were any proposition in economics upon which economists could be said to agree in this set of models, it was that pricing above marginal cost required a market imperfection of some sort (monopoly, oligopoly, etc.).

    Contestability theory has sought to bridge the entire spectrum of the
mainstream theory by the notion of the "contestable monopolist," who would
achieve the least-cost industry structure (equivalent to average cost
pricing for a single product firm in the old theory), yet be encouraged to
charge Ramsey optimal prices above marginal cost by the threat of entry
(Baumol, Bailey, and Willig, 1977). Ramsey efficient pricing schemes above
marginal cost were fully consistent in the new theory with the welfare ideal
of perfect contestability. Unlike orthodox theory, contestability theory
promised only one welfare standard for all cost structures. With constant
returns, the welfare results differed little from the conventional model of
perfect competition. With scale economies the welfare standard was the
perfectly contestable monopolist practicing Ramsey Pricing at prices above
marginal costs. Movements toward contestability (removal of barriers to hit-
and-run entry) did not threaten firm viability (equally efficient new
entrants would face the same total revenue requirement) and were not incom-
patible with Ramsey efficient pricing above marginal costs.
    The "Invisible Hand" of Ramsey Pricing, admittedly, was said to be
"weak" for the contestable monopolist (see Baumol, Bailey, and Willig,
1977). In fact, Ramsey prices are only one among the set of sustainable
prices generally available to the contestable monopolist (Weiss and Lee,
1986).

2.2 Entering the world of imperfect contestability

    The world of perfect contestability posits a firm that is able to
charge a set of prices that recovers total cost to be viable, but is forced
to receive total revenue no more than total cost to deter entry. Given the
condition of perfect contestability, no welfare gains are possible other
than forcing the firm to charge the Ramsey price from among the set of
sustainable prices.
    These welfare properties, however, may tell us little regarding the
appropriate policy for regulators when confronted with a situation of
imperfect contestability. Consider a simple case where the incumbent is
protected from entry by a legal monopoly, say the Private Express Statutes
prohibiting competitive entry to deliver letter mail in competition with the
United States Postal Service. If the goal of regulation is to maximize
static economic welfare through a scheme of highly-discriminatory Ramsey
prices, regulators are instructed by the theory to seek to exploit fully
this impediment to contestability in the form of an entry barrier. Highly
discriminatory Ramsey prices via Baumol and Bradford (1970) can be shown to
minimize the static welfare losses from the necessity to price above
marginal cost to recover the revenue requirement (see Sherman and George,
1979, and Tye and Leonard, 1983, for applications). Indeed, it is possible
to go one step further and observe that degradations of contestability could
be justified by the need to expand the range of sustainable prices available
for choice as Ramsey optimal if the set had been restricted by the threat of
hit-and-run entry.(8) If the goal of regulators is perceived to be the
achievement of economic welfare via static efficient Ramsey prices, the more
welcome are such departures from contestability.(9) In practice, this would
mean exploiting the artificial barrier to entry with extremely high rates for

monopoly first-class mail and much lower rates for competitive classes (those subject to competitive entry).

Regulators, however, were also being told to act as "surrogates for competition unimpeded by entry barriers." This would mean setting postal prices _as if_ the Postal Service faced the threat of entry for first-class mail. (In effect, elasticities and rates for first-class mail would be computed in the Ramsey model as if the Postal Service faced the threat of entry.) First-class rates would be sharply lower than Ramsey levels and competitive classes would be set at net revenue maximizing levels (see Allen, 1986), not the much lower levels indicated by the Ramsey model.

In such practical applications of the theory where markets are imperfectly contestable, the theory of perfect contestability does not give clear instructions to regulators. Unlike in the world of perfect contestability, regulators and antitrust authorities seeking guidance from contestability theory must first decide what end of the conventional spectrum of cost structures they are dealing with. Where technology is subject to constant returns, prices will equal marginal costs and welfare gains though movements toward perfect contestability would appear to be unambiguously welfare-enhancing. Removing impediments to contestability would promise X-efficiency benefits and pricing efficiencies are not achievable. This welfare prescription is of course subject to (i) the pathological cases of unsustainability of the Faulhaber (1975) variety, (ii) the usual "second best" caveats of conventional economic theory, and (iii) concerns expressed by Schwartz and Reynolds (1983), Schwartz (1986), and Stiglitz (1987) that small departures from perfect contestability may produce large departures from the optimum welfare properties of the model. But this of course is more or less what the conventional theory would tell us.

Such reasonably confident welfare prescriptions no longer apply once one confronts the imperfectly contestable monopolist operating in a regime of increasing returns to scale. There, one enters the unclear world of welfare tradeoffs, where movements toward perfect contestability promise to achieve the discipline of the threat of entry but may also deprive incumbents of Ramsey efficient prices that are available only because of departures from perfect contestability. Regulators are then forced to choose between enhancing Ramsey Pricing and advancing contestability. Indeed, they may fear, and certainly will be told by the firms they are seeking to guide through a successful transition to deregulation, that removing impediments to contestability will eliminate any set of prices that will make the firm viable, much less foreclose ones with superior Ramsey-efficient properties. Some surprising policy prescriptions of recent applications of contestability theory to problems of infrastructure access are understandable only in terms of this perceived dilemma.

3. APPLICATION OF THE THEORY TO
PROBLEMS OF COMPETITIVE ACCESS

The theory of contestable markets was initially cited to support the idea that regulators should foster contestability by reducing the importance of sunk costs in industries undergoing a transition to deregulation. "Rather than relying exclusively on traditional rate and entry regulation,"

the preferred policy is "... government intervention to insure equal access to the sunk facility" (Bailey and Baumol, 1984, p. 124). Bailey (1981) recommended consideration of the use of trackage rights (regulatory enforced access by one carrier to another's right-of-way to eliminate the role of sunk costs in preventing contestability) in the rail industry to reduce the need for regulatory review of rate reasonableness. Researchers who have accepted the characterization of perfect contestability as the welfare optimum have generally supported such "competitive access" as a means of eliminating barriers to contestability if such markets are found to be imperfectly contestable (Morrison and Winston, 1987, p. 55).

More recently, however, applications of the theory have characterized promotion of "competitive access" via trackage rights to reinstitute competition eliminated as a consequence of a rail merger as the "worst possible remedy that a malevolent mind could devise" (Baumol, 1984b). The basis in contestability theory for this change in recommendation of policy toward competitive access has not yet been fully explained. While objections to specific policies for determining the price of access have been raised, more generic concerns apparently motivate the objections to regulatory intervention to enhance contestability via competitive access policies in industries undergoing a transition to deregulation. These concerns apparently arise from beliefs that promotion of contestability can actually lead to welfare losses by depriving the incumbent firm of the ability to achieve a viable natural monopoly by exploiting the existence of sunk costs to further the price discrimination via Ramsey Pricing believed necessary for revenue adequacy (Baumol, 1985).

But (i) the claim that maintenance or enhancement of direct competition among incumbents has adverse effects on economic welfare because it drives prices to marginal costs and deprives firms of the market power they need to practice Ramsey Pricing (Baumol and Willig, 1985a, 1985b, 1985c; and Baumol, 1985) is incongruent with (ii) the "competitive market model" that offered a perfectly contestable market as the "standard of welfare-maximizing structure and behavior." Tye (forthcoming) examines numerous applications of the model to other issues of infrastructure access and demonstrates that they share in common this propensity to reject movements toward greater contestability in favor of expanded scope for price discrimination.

The surprising conclusions on competitive access issues in applications of contestability theory to infrastructure access become understandable only in the context of the perceived unsustainability of contestable markets. The "overriding consideration" is argued to be achieving firm viability (Baumol and Willig, 1983b, p. 29). Starting with this objective, the enhancement of contestability can only reduce degrees of pricing freedom believed needed by the regulated firm to achieve revenue adequacy (Phillips, 1981). Indeed, if vigorous intramodal competition produces revenue inadequacy,(10) then the logical conclusion is that sunk costs, cross-subsidies, etc., can improve welfare if they reduce price competition among incumbents. Promoting contestability via enhanced competitive access is thus rejected because it erodes the market power believed to be needed to practice Ramsey Pricing in industries undergoing a transition to deregulation (Baumol and Willig, 1985a, 1985b, 1985c; Tye, 1987; and Meyer and Tye, 1988).

4. THEORETICAL ORIGINS OF THE
PERCEIVED WELFARE TRADEOFF

The welfare tradeoff arises in contestability theory because, as Baumol, Panzar, and Willig (1982, pp. 245, 317; 1986; and Baumol, 1982, pp. 2, 5) demonstrate, price must equal marginal cost in a contestable market to achieve sustainability (i.e., absence of opportunities for profitable entry), unless the market is occupied by a natural monopolist. But marginal cost pricing by multiple incumbents as required to achieve sustainability against profitable entry produces the paradox that Ramsey Prices in excess of marginal cost are no longer possible, and the firms become nonviable (cannot recover total costs).

Baumol and Willig (1983b, pp. 36-37) apply the model to assert that Ramsey Pricing principles are applicable to a regime of railroads engaging in intramodal competition with one another. The paradox is that the equilibrium is viable and sustainable only because of departures from perfect contestability. A successful movement to perfect contestability would force firms to charge prices equal to marginal cost and prevent firm viability.

This paradox -- whether legislative goals of promoting both revenue adequacy and intramodal rail competition are mutually exclusive -- is the oldest regulatory debate in the railroad industry. It actually originated in the historic dispute between Pigou and Taussig as to whether the very elaborate price discrimination observed in the rail industry reflected monopoly power or the necessity for demand-based joint-cost allocation (see Locklin, 1933). Taussig argued that price discrimination in the rail industry was driven by what is now called "economies of scope," whereby different services were produced under conditions of joint costs. Revenue/marginal cost ratios among services would be greater than one and would differ by product line. Price discrimination would endure even under intense intramodal competition because it would be necessary for revenue adequacy. Pigou argued that, on the contrary, rail rate discrimination arises from rail market power driven by economies of scale that permit price discrimination for essentially identical services among differently situated customers. Such discriminatory prices above marginal cost would be undermined by intramodal competition and could persist only under imperfect competition or monopoly. Whether price discrimination reflected market power or the need to recover joint costs seemed to turn on whether the output in different markets was the "same thing."

New attempts to answer these old questions have been offered by applications of the theory of contestable markets to the problems of residual regulation in the rail industry by the Interstate Commerce Commission (ICC). Consistent with Taussig's position that prices in excess of marginal costs are not evidence of rail market dominance, applications of the theory (Baumol, 1979, and Willig, 1984) state that such an industry configuration is viable because such prices in excess of marginal costs are necessary for recovery of joint costs even when each of the firms produces the same multiple outputs and sells them in the same markets.

But Pigou's position also finds support from the theory of contestable markets because a fundamental theorem of contestability is that price (p)

must equal marginal cost (mc) in a contestable market as long as the contested market is not a monopoly. In a contestable market occupied by multiple incumbents, the opportunity for profitable entry will erase discrepancies between price and marginal cost (Baumol, Panzar, and Willig, 1982, p. 317; Baumol, Panzar, and Willig, 1986, p. 344). The reason why price must equal marginal costs in a sustainable contestable market is highly instructive in resolving the Pigou/Taussig paradox. If an incumbent's price exceeds marginal cost, an entrant could profitably increase market share by producing a greater output (Δ X) than an incumbent. The entrant need only offer to share with the incumbent's customers some part of the additional profit from the additional output, (p - mc)Δ X, through an arbitrarily small price reduction. Given the assumptions of contestability, this cut will be sufficient to attract all of the contested incumbent's customers and Δ X from another incumbent.

Indeed, applications of contestability theory implicitly take up Pigou's position against Taussig when they reject the advice that regulators should promote contestability (ease of exit and entry) by "... government intervention to insure equal access to the sunk facility" (Bailey and Baumol, 1984, p. 124). One application (Baumol, 1985) endorses rail mergers between direct competitors on the grounds that intramodal competition drives prices to marginal costs, deprives carriers of the market power they need to engage in Ramsey Pricing, and thereby produces revenue inadequacy, and that "... it is appropriate to do anything which achieves adequate revenues as quickly as possible ..." (Baumol and Willig, 1983b, p. 26, emphasis added). This public policy recommendation on rail mergers is based on nothing other than Pigou's position that prices above marginal costs needed for firm viability require imperfections in intramodal competition (departures from contestability).(11)

Direct price competition among incumbents who must price above marginal costs to be viable is not a sustainable industry equilibrium in highly contestable markets. This property of perfect contestability has profound implications when applied to existing industries undergoing a transition to deregulation, where firms are believed to need prices well above marginal costs for revenue adequacy. Contestability theory resolves the Pigou/Taussig dispute by showing that a movement toward perfect contestability will cause a "market meltdown" where a sustainable equilibrium of viable firms is unattainable in such circumstances.

In fact, this "market meltdown" can be shown to characterize even more general circumstances, e.g., a multimarket equilibrium of contestable monopolists. Intuition tells us that the fact that the profitable price decrease diverts customers from imperfect substitutes rather than perfect substitutes should be irrelevant to the unsustainability result, and such is indeed the case. (See Tye, forthcoming, for proof.)

Consequently, we have a profound result for the prospect that perfect contestability will replace perfect competition as the "standard of welfare-maximizing structure and behavior" (Baumol, 1982, p. 2): contestability can be sustained only in the extreme case of a complete monopolist with zero demand elasticity,(12) and the more general case of a multimarket regime of contestable monopolistic competitors is unsustainable. Nothing new is added by the assumption that each firm is a multiproduct one, and the results are readily extended to the more general case of Braeutigam's (1984)

regime of multiproduct firms producing imperfect substitutes.

Once the perfect contestability model is accepted as "no less than a unifying theory as a foundation for the analysis of industrial organization" (Baumol, 1982, p. 15), the major problem facing regulators seeking a transition to deregulation is perceived to be the need to protect incumbents from unsustainability (failure to become revenue adequate). Proposals to promote contestability via enhanced competitive access to sunk infrastructure are viewed as frustrating the ability to achieve Ramsey Pricing and firm viability. Roadblocks to price competition and entry such as denials of access by incumbents to their sunk facilities thus appear to be a step in the right direction.

5. CONCLUSION

The lessons from these applications of the theory offer constructive suggestions as to how the theory of contestable markets can take its rightful place as an analytic tool and as a guide to economic policy. The theory as yet provides no clear guidelines for correct policy decisions for infrastructure access in situations of imperfect contestability. Movements toward perfect contestability may be viewed in practice as creating static welfare losses by restricting the set of prices available as candidates for Ramsey Pricing, or by even preventing a sustainable equilibrium entirely (a failure to achieve viability in a "market meltdown"). But movements toward perfect contestability promise to achieve the X-efficiency objectives of no excess costs or profits and the prospect of dynamic efficiency gains from a successful transition to deregulation. Movements toward perfect contestability have thus been viewed ambiguously in the applications of the theory. Appropriate policy judgments therefore require a tradeoff of the opposing welfare effects of any proposed change in market structure when one applies the theory to problems of competitive access to sunk infrastructure in transportation industries undergoing a transition to deregulation.

REFERENCES

1. This paper is based on a forthcoming book, The Theory of Contestable Markets: Applications to Regulatory and Antitrust Problems in the Rail Industry, Greenwood Press.

2. A vertical foreclosure arises when the firm owning the bottleneck restricts access to it or engages in a restrictive practice that has a substantial adverse impact on competition in upstream or downstream markets.

3. "The crucial feature of a contestable market is its vulnerability to hit-and-run entry." See Baumol (1982) and Baumol, Panzar, and Willig (1982).

4. See Baumol and Willig (1983a) and (1983b) and Interstate Commerce Commission (1983). The ICC's views are based on the contestable market theories and were recently supported by 14 other prominent economists,

including George Stigler, Almarin Phillips, Kenneth Arrow, Elizabeth E. Bailey, and Ann F. Friedlaender. See <u>Comments of Five Railroads</u> (1983) and AAR (1985).

5. The necessity to impose a lag in the pricing response of the incumbent in the post-entry world was only implicit in the contestability model as initially specified by Baumol, Panzar, and Willig (1982 pp. 5, 9, 11, and 361). Its crucial role appears to have been first observed by Dixit (1982), who noted that a lag is necessary to preclude the incumbent from deterring entry by threatening to slash prices faster than the incumbent can exit the market. The idea of permitting the entrant to achieve this lag via contracts with customers prior to entry apparently came as an afterthought to the theory. For development of the concept of lagged price response by incumbents, see Bailey and Baumol (1984) pp. 114-115, Brock (1983), Schwartz and Reynolds (1983), Baumol, Panzar, and Willig (1983), pp. 492-493, Perry (1984), Bailey and Friedlaender (1982), pp. 1040, 1041, and Stiglitz (1987).

6. See Baumol, Panzar, and Willig (1986), p. 341 and (1982), pp. 24-25, and Bailey and Friedlaender (1982).

7. The origins of the theory as applied to a monopolist operating under constant returns goes back considerably. Samuelson (1947, pp. 78-79) noted that with perfectly free entry a monopolist "... would find its maximum advantage in behaving like a pure competitor." It is important to note, however, that Samuelson was addressing the case of the contestable monopolist operating in a range of constant costs, not decreasing costs, such as would more generally characterize a true contestable monopoly.

8. The situation where movement toward perfect contestability would eliminate any set of variable prices is the most extreme case of the conflict between movements toward contestability and achieving the Ramsey-efficient optimum. Even if the set of sustainable prices was not null, enlargements of the set via creation of impediments to contestability would be justified by the theory if a more static efficient Ramsey price set were made available. (See Phillips, 1980, and Braeutigam, 1979).

9. Note that this is an extension of the unsustainability problem first developed by Faulhaber (1975), which concerned the threat of "uneconomic bypass" that would raise total industry costs. The threat of entry can foreclose more Ramsey-efficient price sets for the sustainable monopolist as well.

10. Baumol and Willig (1985c) provide numerous examples where prices are driven down to marginal costs by intramodal competition.

11. See Baumol and Willig (1982 pp. 30-31) for statements of concern that intramodal rail competition will drive price to marginal cost and violate the firm viability requirement.

12. Baumol (1982, p. 5) states that the profit opportunity from price

excess of marginal cost "crumbles into dust" as long as the contestable volume is "fixed." The average revenue curve implicitly assumes no possibility of transitory price discrimination by the new entrant and no elasticity of demand (no competition from even imperfect substitutes).

BIBLIOGRAPHY

Allen, W. Bruce, "Ramsey Pricing in the Transportation Industries," International Journal of Transport Economics, Vol 13, No. 3 (October 1986): 293-330.

Association of American Railroads (AAR), "Nation's Leading Economists Endorse Staggers," Washington, D.C.: AAR, 2 May 1985. Reprinted in Railway Age, June 1985, p. 32.

Bailey, Elizabeth E., "Contestability and the Design of Regulatory and Antitrust Policy," American Economic Review, Vol. 71, No. 2 (May 1981): 178-183.

Bailey, Elizabeth E., and William J. Baumol, "Deregulation and the Theory of Contestable Markets," Yale Journal on Regulation, Vol. 1, No. 2 (1984): 1, 111-137.

Bailey Elizabeth E., and Ann F. Friedlaender, "Market Structure and Multiproduct Industries," Journal of Economic Literature, Vol. 20, No. 3 (September 1982): 1024-1048.

Baumol, William J., "Minimum and Maximum Pricing Principles for Residual Regulation," Eastern Economic Journal, Vol. 5, Nos. 1-2 (January 1979): 235-248.

_____, 1982, "Contestable Markets: An Uprising in the Theory of Industry Structure," American Economic Review, Vol. 72, No.1 (March 1982): 1-15.

_____, 1983a, Verified Statement in Finance Docket No. 30,300, CSX Corporation -- Control -- American Commercial Lines, Inc., before the Interstate Commerce Commission, dated 4 November 1983.

_____, 1984b, Verified Statement in Finance Docket No. 30,400, Santa Fe Southern Pacific Corporation -- Control -- Southern Pacific Transportation Company: Merger -- the Atchison, Topeka and Santa Fe Railway Company and Southern Pacific Transportation Company, dated March 1984 and Transcript pp. 10,084, 10,198.

_____, Verified Statement in Finance Docket No. 30,400, Santa Fe Southern Pacific Corporation -- Control -- Southern Pacific Transportation Company: Merger -- the Atchison, Topeka and Santa Fe Railway Company and Southern Pacific Transportation Company, dated 10 July 1985.

Baumol, William J., Elizabeth E. Bailey, and Robert D. Willig, "Weak Invisible Hand Theorems on the Sustainability of Multiproduct Natural Monopoly," American Economic Review, Vol. 67, No. 3 (June 1977): 350-365.

Baumol, William J., and David F. Bradford, "Optimal Departures from Marginal Cost Pricing," American Economic Review (June 1970): 265-283.

Baumol, William J., John C. Panzar, and Robert D. Willig, Contestable Markets and the Theory of Industry Structure, New York: Harcourt Brace Jovanovich, Inc., 1982.

_____, "Contestable Markets: An Uprising in the Theory of Industry Structure: Reply," American Economic Review, Vol. 73, No. 3 (June 1983): 491-496.

_____, "On the Theory of Perfectly Contestable Markets," in New Developments in the Analysis of Market Structure, Joseph E. Stiglitz and G. Frank Mathewson, eds. Cambridge, MA, 1986.

Baumol, William J., and Robert D. Willig, Verified Statement before the Interstate Commerce Commission, Ex Parte No. 347 (Sub-No. 1), Coal Rate Guidelines -- Nationwide, 13 April 1982.

_____, 1983a, Verified Statement Before the Interstate Commerce Commission, Ex Parte No. 347 (Sub-No. 1), Coal Rate Guidelines: Nationwide, 28 July 1983.

_____, 1983b, "Pricing Issues in the Deregulation of Railroad Rates," in Economic Analysis of Regulated Markets, Jorg Finsinger, ed., New York: St. Martin's Press, 1983.

_____, 1985a, Verified Statement before the ICC, Ex Parte No. 456, The Staggers Rail Act of 1980 -- Conference of Interested Parties, 16 January 1985.

_____, 1985b, Verified Statement before the ICC, Ex Parte No. 445 (Sub-No. 1), Intramodal Rail Competition, 31 May 1985.

_____, 1985c, Verified Statement before the ICC, Ex Parte No. 445 (Sub-No. 1), Intramodal Rail Competition, 8 July 1985.

_____, 1986, "Contestability: Developments Since the Book," Oxford Economic Papers, Vol. 38 (1986): 9-36.

Braeutigam, Ronald R., "Socially Optimal Pricing with Rivalry and Economies of Scale," The Rand Journal of Economics, Vol. 15, No. 1 (Spring 1984): 127-134.

Brock, William A., "Contestable Markets and The Theory of Industry Structure: A Review Article," Journal of Political Economy, Vol. 91

(December 1983): 1055-66.

Chamberlain, Edward H., The Theory of Monopolistic Competition, Cambridge: Harvard University Press, 1933.

Dixit, Avinash, "Recent Developments in Oligopoly Theory," American Economic Review, Vol. 72, No. 2 (May 1982): 12-17.

Ekelund, Robert B., Jr., and Joe R. Hulett, "Joint Supply, the Taussig-Pigou Controversy and the Competitive Provision of Public Goods," Journal of Law and Economics, Vol. 16 (1973): 369-387.

Faulhaber, Gerald R., "Cross Subsidization: Pricing in Public Enterprises," American Economic Review, Vol. 65, No. 5 (December 1975): 966-977.

Five Railroads, Comments of, before the Interstate Commerce Commission, Ex Parte No. 347 (Sub-No. 1), Coal Rate Guidelines -- Nationwide, 28 July 1983.

Interstate Commerce Commission, Ex Parte No. 347 (Sub-No. 1), Coal Rate Guidelines -- Nationwide, Decision dated 8 February 1983.

Levine, Michael E., "Airline Competition in Deregulated Markets: Theory, Firm Strategy, and Public Policy," Yale Journal on Regulation, Vol. 4, No. 2 (Spring 1987): 393-494.

Locklin, D. Phillip, "The Literature on Railway Rate Theory," The Quarterly Journal of Economics (February 1933): 167-230.

Meyer, John R., and William B. Tye, "The Regulatory Transition," American Economic Review, Vol. 75, No. 2 (May 1985): 46-51.

_____, "Toward Achieving Workable Competition in Industries Undergoing a Transition to Deregulation," Yale Journal on Regulation, Vol. 5, No. 2 (Summer 1988): 273-297.

Morrison, Steven, and Clifford Winston, "Empirical Implications and Tests of the Contestability Hypothesis," Journal of Law and Economics, Vol. 30 (April 1987): 53-66.

Perry, Motty, "Sustainable Positive Profit Multiple-Price Strategies in Contestable Markets," Journal of Economic Theory, Vol. 32 (1984): 246-265.

Phillips, Almarin, "Ramsey Pricing and Sustainability with Interdependent Demands," in Regulated Industries and Public Enterprise, Bridget M. Mitchell and Paul R. Kleindorfer, eds. (Lexington, Mass.: D. C. Heath and Company, 1980).

Samuelson, Paul A., Foundations of Economic Analysis, Cambridge, MA: Harvard University Press, 1947.

Schwartz, Marius, "The Nature and Scope of Contestability Theory," <u>Oxford Economic Papers</u>, Vol. 38 (November 1986 Suppl.): 37-57.

Schwartz, Marius, and Robert J. Reynolds, "Contestable Markets: An Uprising in the Theory of Industry Structure: Comment," <u>American Economic Review</u>, Vol. 73, No. 3 (June 1983): 488-90.

Shepherd, William G., "'Contestability' vs. Competition," <u>American Economic Review</u>, Vol. 74, No. 4 (September 1984): 572-587.

_____, "Illogic and Unreality: The Odd Case of Ultra-Free Entry and Inert Markets," in <u>Antitrust and Regulation</u>, Ronald E. Grieson, ed., Lexington, MA: Lexington Books, 1986.

Sherman, Roger and Anthony George, "Second Best Pricing for the U.S. Postal Service," <u>Southern Economic Journal</u>, Vol. 45 (January 1979): 685-695.

Spence, Michael, "Contestable Markets and the Theory of Industry Structure: A Review Article," <u>The Journal of Economic Literature</u>, Vol. 21, No. 3 (September 1983): 981-990.

Stiglitz, Joseph E., "Potential Competition May Reduce Welfare," <u>American Economic Review</u>, Vol. 71, No. 2 (May 1981): 184-189.

_____, "Technological Change, Sunk Costs, and Competition," paper prepared for a conference at the Brookings Institution, Washington, D.C., December 1987.

Tye, William B., 1987, "Pricing Rail Competitive Access in the Transition to Deregulation with the Revenue/Variable Cost Test," <u>Antitrust Bulletin</u>, Vol. 32, No. 1 (Spring 1987): 101-135.

_____, forthcoming, <u>The Theory of Contestable Markets: Applications to Regulatory and Antitrust Problems in the Rail Industry</u>, Greenwood Press.

Tye, William B. and Herman Leonard, "On the Problems of Applying Ramsey Pricing to the Railroad Industry with Uncertain Demand Elasticities," <u>Transportation Research</u>, Vol. 17A, No. 6 (November 1983): 439-450.

Weiss, Nitzan and Phil Lee, "Sustainability of the Multiproduct Monopoly and Ramsey Optimal Pricing," <u>Journal of Institutional and Theoretical Economics</u>, Vol. 142 (1986): 473-492.

Willig, Robert D., Verified Statement in Docket No. 38279S et al., <u>Detroit Edison v. Consolidated Rail Corporation et al.</u>, 13 February 1984.

Willig, Robert D., and William J. Baumol, "Using Competition as a Guide," <u>Regulation</u>, No. 1 (1987): 28-35.