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BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Amendment of Part 90 of	)	PR Docket No. 93-61
the Commission's Rules	)	RM-8013
to Adopt Regulations for	)	
Automatic Vehicle	)	
Monitoring Systems	)	

MOTION OF SOUTHWESTERN BELL MOBILE SYSTEMS, INC.
TO ACCEPT SUPPLEMENT TO REPLY COMMENTS

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October 15, 1993

BEFORE THE
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MOTION OF SOUTHWESTERN BELL MOBILE SYSTEMS, INC.
TO ACCEPT SUPPLEMENT TO REPLY COMMENTS

Southwestern Bell Mobile Systems, Inc. ("SBMS"), by its attorneys, hereby requests that the Commission accept the attached supplement to the SBMS Reply Comments in the above-captioned proceeding. The supplement consists of a paper prepared by Dr. Leland L. Johnson entitled "Competition In Wideband Location Monitoring Services," which analyzes a previously-filed study by Drs. Richard Schmalensee and William E. Taylor in this rulemaking proceeding.[1/] As shown below, good cause exists for accepting the SBMS supplement.

In preparing its Reply Comments, SBMS reviewed and considered all comments filed in this proceeding but devoted particular attention to Teletrac's Comments, including the study by Schmalensee and Taylor. During this period of review and preparation of its own Reply Comments and after some deliberation,

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1/ The Schmalensee and Taylor study, "The Economics Of Co-Channel Separation For Wideband Pulse Ranging Location Monitoring Systems," is Appendix 3 to the Comments of North American Teletrac and Location Technologies, Inc. ("Teletrac") filed June 29, 1993 in this proceeding.

SBMS became convinced that a complete record and an informed Commission decision would require an expert response to the Schmalensee/Taylor study. SBMS was prepared to underwrite such an analysis but concluded that any expert it retain must be a highly qualified economist, experienced in analyzing telecommunication markets and services, and, preferably, with a track record in providing testimony to the Commission.

Beginning the second week of July, SBMS initiated its search for an expert who satisfied the aforementioned criteria. Over about the next six weeks, SBMS reviewed the qualifications and experience of numerous economic scholars, and contacted at least three distinguished economists who considered SBMS's proposal but ultimately declined for various reasons-- including conflicting prior commitments, vacation schedules and a time constraint which, considering the impending reply deadline in this proceeding, SBMS felt obliged to impose.[2/] This time constraint was made even more daunting by the complexity of the relevant issues and the length of the Schmalensee/Taylor study.

[2/] Specific approaches were made by SBMS to Dr. Thomas Hazlett (University of California), Dr. Robert Litzenberger (University of Pennsylvania) and Dr. William Baumol (New York University). These individuals all indicated that they were unable to review and analyze the Schmalensee/Taylor study and prepare a detailed, written evaluation thereof within the time limit imposed by SBMS.

It was only in the last week of August that SBMS was fortunate to contact Dr. Leland Johnson, arranged for him to review the Schmalensee/Taylor study, and ascertained his availability to prepare a written analysis thereof. Since that time, Dr. Johnson has been engaged in this effort, which required him to review relevant literature, consult with LMS experts both within and outside SBMS, and prepare preliminary and final drafts of his analysis. The result is attached hereto as a supplement to SBMS's Reply Comments in this proceeding.

Dr. Johnson's attached paper establishes with certainty that a complete and meaningful record in this proceeding compels inclusion of an expert response to Schmalensee/Taylor. As Dr. Johnson notes:

> Schmalensee and Taylor apply economic theory in such a misleading way, and within the context of assumptions so disconnected from the real world, that their analysis is of little value to the Commission's deliberations. (Johnson Paper at 2.)

Indeed, Dr. Johnson's attached analysis is replete with specific examples of the deceptive manner in which Schmalensee and Taylor invoke economic theory to justify Teletrac's preferred licensing scheme for LMS.[3/] On this basis alone, the SBMS supplement merits

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3/ For example, Dr. Johnson demonstrates that Schmalensee and Taylor assume that all potential wideband LMS providers will have identical cost, service and operating characteristics. Evaluating these assumptions, Dr. Johnson testifies:

> With all firms having identical costs and services and with total output fixed, there simply is no way that competition <u>could</u> confer any benefit in the Schmalensee-Taylor world. (Johnson Paper at 4, emphasis in the original.)

inclusion in the instant record.

SBMS respectfully submits that it has shown good cause for the Commission to include the attached supplement to SBMS's Reply Comments in the record of this proceeding and to accord it prominent consideration when deciding the critical issues presented by this rulemaking.

Respectfully submitted,

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October 15, 1993

COMPETITION IN WIDEBAND LOCATION MONITORING SERVICES

Leland L. Johnson

Under the Commission's interim rules, two 8 MHz bands are designated in each local market for wideband AVM (or LMS) services. Most of the licenses that have been issued are in the hands of Teletrac and MobileVision for wideband pulse ranging (WBPR) systems. A key issue in the design of permanent rules is whether more than two licenses should be granted in each market, either by spectrum sharing among licensees or by a reduction in the bandwidths available to each. Teletrac and MobileVision emphasize that sharing is infeasible and that any reduction in the assigned 8-MHz bandwidths for broadband services would severely compromise their ability to operate. Southwestern Bell Mobile Systems, Inc. (SBMS), concluding that unlimited sharing is infeasible, proposes that the two 8-MHz bands each be divided into 4-MHz bands to enable as many as four wideband LMS licensees to operate side by side.

In support of its position, Teletrac appended to its comments a submission by Richard Schmalensee and William E. Taylor "the Economics of Co-channel Separation for Wideband Pulse Ranging Location Monitoring Systems". Applying economic theory, they argue that no more than two WBPR LMS licenses should be issued in each market. Thus, each licensee would face no more than one competitor. They maintain that (a) operation on a non-exclusive, shared spectrum basis will not necessarily cause the number of competitors to increase, (b) expanding the number of competitors will not necessarily reduce price, (c) expanding the number of competitors will not result in more efficient spectrum use, (d) expanding the number of competitors will not result in more technological diversity, and (e) entry of additional LMS competitors will impose additional costs on society.

However, Schmalensee and Taylor apply economic theory in such a misleading way, and within the context of assumptions so disconnected from the real world, that their analysis is of little value to the Commission's deliberations. By assuming away the very factors that might generate benefits from competition, they necessarily conclude that additional competition would result largely in burdening society with additional costs. Anyone who takes seriously their analysis would be led to believe that the Commission should simply revoke the licenses held by Teletrac and MobileVision and assign the full 16 MHz in each geographical market to a single licensee who, as a monopolist, would offer service more efficiently.

To evaluate their study, this paper addresses five topics: (a) competition and annual costs, (b) competition and efficiency in spectrum use, (c) demand elasticity and competitive price reductions, (d) the appeal of monopoly in a Schmalensee-Taylor world, and (e) encouraging entry into the wideband LMS market.

Competition and Annual Costs

Implicit in their analysis is the assumption that all wideband LMS providers share identical characteristics. They all have equally efficient managements, they offer exactly the same services, and they face the same costs for given outputs. This assumption leads Schmalensee and Taylor into a maze of troublesome assertions and meritless conclusions.

This distressing situation arises most strikingly in their attempt to show how added competition would increase overall costs by requiring duplicative expenditures, such as on equipment, marketing, advertising, and administration (at 28). Drawing from Teletrac's operating expense data for its Los Angeles system, they estimate that "four firms serving the market would have annual operating expenses that totalled about 47 percent higher than two

firms providing the same amount of capacity [and] the operating costs of eight firms serving the market would total about 142 percent higher than two firms serving the same market." (at 29).

To understand how Schmalensee and Taylor calculate these percentage changes, we must try to reconstruct their calculations since they provide no supporting detail for their numbers. In Table 1, the "one firm" columns show the variable cost of $4 million and the fixed cost of $1.7 million for the Teletrac system operating in Los Angeles -- the only wideband LMS system operating there. Assuming that a single firm in a hypothetical market would have the same annual costs as reported in Los Angeles ($4 million and $1.7 million), Schmalensee and Taylor reason that a second firm in that market would also have a fixed cost of $1.7 million. Under the further assumption that total capacity is held constant in that market, they divide the capacity equally between the two firms, with each therefore bearing an operating cost of $2 million. In the four-firm case, each would bear the $1.7 million fixed cost and 25 percent (or $1 million) of the total market operating cost of $4 million. The results are similar for eight firms with each bearing its proportionate share of the $4 million total variable cost. Thus, the total cost for the four-firm market ($10.8 million) is 46 percent greater than that of the two-firm market ($7.4 million), while the total for the eight-firm market ($17.6 million) is 138 percent greater than that of the two-firm market. [8]

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[8] Schmalensee and Taylor report 47 percent rather than 46 percent and 142 percent rather than 138 percent. These discrepancies arise apparently because of rounding errors.

Table 1

Annual Operating Costs (Millions $) and Number of Firms

One Firm		Two Firms		Four Firms		Eight Firms	
Variable Cost	Fixed Cost	Variable Cost	Fixed Cost	Variable Cost	Fixed Cost	Variable Cost	Fixed Cost
4.0	1.7	2.0	1.7	1.0	1.7	0.5	1.7
		2.0	1.7	1.0	1.7	0.5	1.7
				1.0	1.7	0.5	1.7
				1.0	1.7	0.5	1.7
						0.5	1.7
						0.5	1.7
						0.5	1.7
						0.5	1.7
4.0	1.7	4.0	3.4	4.0	6.8	4.0	13.6

This exercise is profoundly troubling. With all firms having identical costs and services and with total output fixed, there simply is no way that competition could confer any benefit in the Schmalensee-Taylor world.

Why do they single out WBPR systems for such bizarre cost analysis? The answer flows from their contention that, for a given 16 MHz allocation, maximum capacity is fixed regardless of the number of firms. Difficulties immediately arise, however, because this view of the world ignores possibilities that some firms may (a) be more innovative than others in squeezing additional capacity out of a given spectrum assignment, (b) succeed in developing differentiated services that expand WBPB markets, (c) have lower costs, including lower fixed costs, by discovering technologies superior to those of other firms.

Difficulty arises also in squaring the cost calculations in Table 1 with the intentions by SBMS and others to enter the LMS market. Why would competitive entry ever be rational, given that a single firm can produce the fixed total output at lower total cost than can any combination of firms?

Having illustrated the characteristics of natural monopoly,[9] Schmalensee and Taylor remain silent about why SBMS, or any other firm, would seek to compete. Indeed, they fail to explain why even two firms -- namely Teletrac and MobileVision -- would opt to hold licenses in the same market. In an earlier study, Schmalensee concludes, contrary to what we observe in the LMS market, "In most situations that involve natural monopoly, it is hard to imagine the threat of new entry being especially strong."[10]

Going beyond operating costs, Schmalensee and Taylor note that each potential entrant must expect to recover its cost of developing or licensing the technology.

> From Teletrac's experience, the one-time costs of research and development are in excess of $60 million with additional tens of millions likely to be incurred. Conservatively amortizing this sunk cost over 10 years with a 10 percent discount rate would add about $10 million to the annual cost that must be covered for entry to be profitable. (at 30).

The observation that R&D costs must be covered is true enough as a generality, but Schmalensee and Taylor ignore the fact that these costs vary widely among firms. As a case in point, SBMS proposes to use the Quiktrak technology that has already been developed and is in routine operation in Australia. With basic R&D costs incurred, the incremental cost of bringing this technology to the United States is surely much less than the R&D figures quoted for Teletrac. Here, as elsewhere, their implicit assumption that all firms are alike undermines whatever useful contribution Schmalensee and Taylor might otherwise have made.

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[9] As Schmalensee observed in his earlier study, "An industry or activity is said to be a natural monopoly if production is most efficiently done by a single firm or other entity." The Control of Monopolies, D.C. Heath, 1979, at 3.

[10] Id. at 109. With respect to competitive entry, he quotes Alfred Kahn as posing "the key question": "If competitors want to enter, how natural can monopoly be?" (Id. at 107). According to Schmalensee's own writings, the proposed entry by SBMS and others demonstrates that the numbers in Table 1 are misleading.

With respect to whether competition strengthens incentives for operating efficiencies, Schmalensee and Taylor note that "at any point in time, each firm in market has nearly the same incentive to minimize cost regardless of the number of firms in the market. Every dollar that the monopolist can save by controlling costs increases profit by a dollar, and a firm in a competitive market perceives precisely the same tradeoff." (at 15-16). In a sense, they are quite correct. So long as all firms seek to maximize profits, the monopolist has just as much incentive to minimize cost for any given output as does the firm facing many competitors.

Again, however, Schmalensee and Taylor are led astray by their implicit assumption that one firm is like any other. They fail to recognize that some managements are <u>better</u> at the job of minimizing costs than others. While all may have strong incentives to minimize costs, <u>outcomes</u> depend on a host of factors, including the skills, interests, and perceptions of specific managements in coping with an ever changing environment of new products, technologies, and evolving consumer tastes. Thus, a particular competitor may be more successful at cost containment than others. Or a monopolist may be more successful (or less so) at minimizing costs than would competitive firms in the same industry.

Critical to an efficient market economy is a filtering mechanism that encourages the survival of whichever firms are most successful at operating efficiently, while bringing about the demise of those that perform poorly. Reliance on competition is commonly accepted as the best way to perform this filtering function.

Professor Schmalensee's own writings place him in the mainstream of economists who emphasize the critical role of competition in enhancing social welfare. Indeed, in his study of the ready-to-eat (RTE) breakfast cereal industry he urged far-reaching measures of government

intervention to force the industry (dominated by four producers) to become more competitive.[11]

In the case of wideband LMS, the question before the FCC is how to structure the competitive process to encourage survival and growth of firms whose presence most contributes to the social welfare. The observation, drawn from economic theory, that monopolists have as strong an incentive to minimize costs as do competitors, simply misses the point.

Competition and Efficiency in Spectrum Use

Similar to their sterile treatment of operating costs, Schmalensee and Taylor seek to demonstrate that competition leads to inefficiency in spectrum use by reducing the capacity available from a given overall allocation of spectrum to wideband LMS. Three aspects of their analysis are notable. First, in the same way that competitive firms would be forced into duplicative expenditures for equipment and such, they would be forced into duplicative requirements for "spectrum overhead".

> "WBPR LMS systems also use a certain amount of capacity in the form of overhead transmissions to calibrate the system and to establish, monitor, and re-establish system synchronization. Using current technology, such transmissions for an 8 MHz firm comprise between 5 and 15 percent of its current system capacity. Two firms sharing the 8 MHz would each require the same amount of overhead capacity as the single 8 MHz firm, [emphasis added] so that doubling the number of firms would double the required total amount of overhead capacity. (at 30-31).

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[11] Schmalensee, "Entry Deterrence in the Ready-to-Eat Breakfast Cereal Industry", The Bell Journal of Economics, Autumn 1978 at 305-327. In 1972 the Federal Trade Commission brought suit against the four largest producers (later reduced to three) on grounds that their practices of proliferating brands, differentiating similar products and promoting trademarks through intensive advertising resulted in high barriers to entry into the RTE cereal market. As a remedy, the FTC proposed (a) divestiture to create five new firms by requiring the respondents to spin off certain brands and trademarks, and (b) requirements that these firms license their existing trademarks and cereal formulae on a royalty-free basis to any firm willing to meet quality control standards (at 321). After analyzing the case, Schmalensee concluded that "The relief proposed by the FTC thus seems to provide a sound solution to the problem in normative economics posed by the RTE cereal industry's performance" (at 323).

Persisting in seeing the world as a homogeneous set of firms, Schmalensee and Taylor ignore possibilities that spectrum overhead requirements vary, depending on management skills, technology and other factors. Especially, they fail to recognize possibilities that survivors in a competitive LMS marketplace would tend to be those firms that succeed in reducing their spectrum overheads, as well as operating efficiently in other dimensions. By assuming away all such differences among firms, and the source of potential competitive benefits to society, Schmalensee and Taylor necessarily are left with only the downside of competitive entry.

Second, they set forth an "iron law of signal detection" (at 38) according to which the "unit costs of capacity are inversely proportional to the square of the bandwidth of the system."

> Suppose 8-MHz were divided between two competitors, giving each 4 MHz. This allocation would permit 4 WBPR LMS competitors in each geographic market, but it would be an inefficient use of spectrum because the capacity of the system -- for a given level of accuracy -- is directly proportional to the square of the bandwidth. If the nominal capacity of the single 8 MHz firm is 500,000 units, two 4 MHz firms would together have the nominal capacity of 250,000 units and the total capacity of four 2 MHz firms would be 125,000 units. (at 32-33).

We must immediately note that, on technical grounds, Schmalensee and Taylor's iron law does not work in the real world as they describe it.[12] Beyond such technical considerations, moreover, Schmalensee and Taylor ignore possibilities that some LMS providers may, by

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[12] Multipath distortion associated with 900 MHz wideband LMS systems causes a reduction in system capacity below the Pickholtz calculations on which Schmalensee and Taylor rely. "The tradeoff analysis in the Pickholtz report is based on the Cramer-Rao inequality and implicitly assumes that signal coherence is maintained over the whole of the occupied bandwidth. This is a reasonable assumption for line-of-sight propagation paths which are not dispersive, that is, where multipath effects are negligible. However, terrestrial LMS systems of the type being considered here almost always operate in cluttered environments where radio propagation from mobile transmitters to base receivers is multipath in character and rarely line-of-sight." (SBMS Reply Comments, Exhibit 4 at 2.)

choosing alternative technologies, use spectrum more efficiently than others or have other characteristics that differentiate their offerings from those of competitors. As a case in point, SBMS says that the Quiktrak LMS system it "intends to deploy in Chicago is based on a technology which can, within 2 MHz of spectrum, provide an initial capacity for up to 60,000 location messages per hour. It is contemplated that within that same 2 MHz of spectrum, capacity can be increased to 120,000 locations per hour".[13]

Third, their concerns about spectrum constraints are grounded on a faulty criterion for judging efficiency of spectrum use. They assert that the provision of wideband LMS services in the manner "which most efficiently uses the scarce resource of spectrum is one in which the greatest number of subscribers can be served in a market for a given allocation of bandwidth" (at 13-14). Here, as elsewhere, Schmalensee and Taylor are wide of the mark. We can easily imagine a situation in which one service attracts fewer subscribers than others but, because it is more highly valued by subscribers, it embodies the most efficient use of spectrum resources.

To illustrate, consider a situation in which a given amount of spectrum can be assigned either to Service 1 or Service 2. Suppose that Service 1 attracts 100,000 subscribers, who collectively are willing to pay $1 million, with the service costing a total of $300,000. In this case, subscribers value the service at $700,000 over and above the cost of $300,000. In comparison, suppose that Service 2 attracts fewer subscribers, only 80,000 instead of 100,000, but subscribers in the aggregate value Service 2 at $1.5 million. Suppose further that the total cost of Service 2 is the same as for Service 1 -- $300,000. Thus, subscribers value Service 2

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[13] SBMS Comments at 7-8.

at $1.2 million in excess of cost. Faced with the choice between the two for assignment of spectrum, we would choose Service 2 because the net benefit or "surplus" is higher -- $1.2 million compared with only $700,000.

Figure 1
Service 1

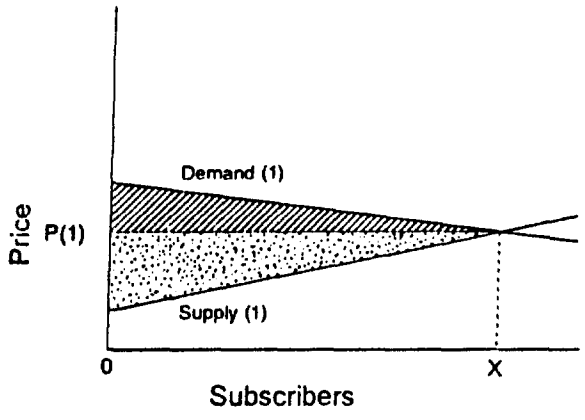
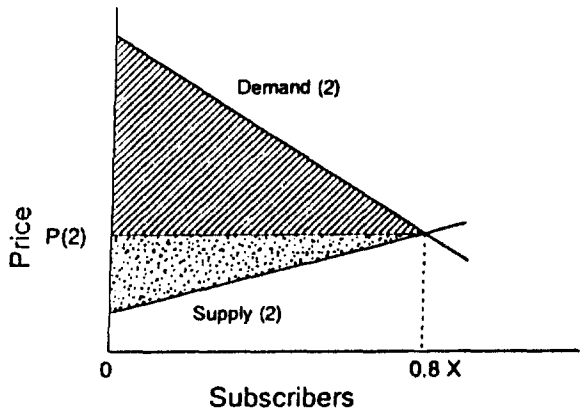


Figure 2
Service 2



The situation can be illustrated more formally with Figures 1 and 2. Figure 1 shows the demand curve and the supply curve for Service 1 under the assumption that the spectrum is assigned to it. The price for the service, determined by the intersection of the two curves, is given by P(1), with X subscribers using the service. Similarly, Figure 2 shows the situation for Service 2 whose demand calls forth 0.8X subscribers -- only 80 percent of the subscribers that would have signed up for Service 1 as an alternative.

In light of their emphasis or maximizing the number of subscribers, Schmalensee and Taylor would opt for Service 1. But, as the figures are drawn, this would be the wrong choice. To understand why, we must take into account the critical roles played by the concepts of "consumer surplus" and "producer surplus". Consumer surplus is defined as the aggregate amount consumers would have been willing to pay for the service, over and above what they

actually do pay. The parallel concept of producer surplus is defined as the revenues that producers of the service receive in excess of the minimum amounts they would have been willing to accept. In Figures 1 and 2, consumer surplus is illustrated by the hatched triangular area above the horizontal price line and below the demand curve. Producer surplus is illustrated by the stippled triangular area below the price line and above the supply curve. Despite the fact that it attracts fewer subscribers, Service 2 should be chosen because the sum of consumer and producer surplus is larger than that for Service 1. Because subscribers value Service 2 more highly, revealed by the relatively high prices they would be willing to pay, Service 2 makes more efficient use of spectrum resources.

In short, the number of subscribers is only one factor that enters into the calculus of social gains from spectrum use. Others are the costs of production and the valuation of the service by subscribers. The concepts of consumer and producer surplus are highly useful tools for simultaneously taking into account these factors in determining the social welfare effects of alternative economic activities.

Nothing in Figures 1 and 2 is new or novel. Consumer and producer surplus are among the most basic concepts used by economists.[14] Of course, Schmalensee and Taylor are

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[14] See, for example, H. Kohler, Intermediate Microeconomics, Second Edition, at 200-210. For an instructive example of how the concepts of consumer and producer surplus are used to treat issues of public policy in telecommunications, see Evan Kwerel and John Williams, Changing Channels: Voluntary Reallocation of UHF Spectrum, FCC Office of Plans and Policy Discussion Paper No. 27, November 1992. They ask whether and by how much, society would benefit if spectrum used by a single UHF broadcasting station in the Los Angeles metropolitan area were assigned instead to a new cellular telephone service to compete with the two existing cellular providers. By estimating the sum of additional consumer and producer surplus generated by the transfer, they conclude that society would benefit by more than $1 billion (in present value).

thoroughly familiar with their application. Indeed, in an excellent journal article, Professor Schmalensee relies on these concepts in comparing the outcomes of rate-of-return and price-cap regulatory regimes.[15] Why they ignore such obviously relevant concepts here remains a mystery.

Competition and Technological Diversity

Schmalensee and Taylor assert that the range of LMS services made available to consumers through application of differing technologies has nothing to do with the number of LMS providers in the market. Even if Teletrac and MobileVision were the only wideband LMS providers in a single geographical market, "both systems would have an incentive to innovate or to adopt any technologies that lowered costs or expanded capacity." (at 20-21). They continue "under the Commission's flexible rules, competition among technologies -- even for WBPR LMS systems in the 900 MHz band -- would not be constrained by a limitation on the number of firms in each market". (at 21). According to their view, if Quiktrak is the best technology either Teletrac or MobileVision (or both) would adopt it. The benefits of Quiktrak would be available to the American public regardless of whether Southwestern Bell enters the wideband LMS market.

Consistent with their implicit assumption that all firms are identical, Schmalensee and Taylor assume that all LMS providers agree about which technologies are superior. They ignore possibilities that Teletrac and MobileVision may believe that their own technologies are superior,

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[15] "Good Regulatory Regimes", RAND Journal of Economics, Autumn 1989, at 417-436. In another article, in which he applies surplus analysis to assessment of social benefits, he insightfully shows the importance of distinguishing between production of final goods and of intermediate goods. "Consumer's Surplus and Producer's Goods", American Economic Review, September 1971 at 682-687.

while SWBS, the proponent of Quiktrak, concludes that its technology is better in terms of its spectrum efficiency and cost of operation as revealed by its use in Australia. Schmalensee and Taylor seem oblivious to the possibility that, because of differing management assessments, Quiktrak would not be offered unless SBMS were able to enter the market.

As earlier emphasized, the essence of a dynamic economy is diversity -- including various skills, interests, and perceptions of managers, differing views about which technologies are most promising in both the short run and the long run, and disagreements about what consumers want and are willing to pay for it. Sorting out which combinations are in fact most socially beneficial requires that full rein be given to the testing of differing views and strategies in the marketplace. Restricting wideband LMS to just two service providers in each market would pose the danger of unduly constraining this process, thereby denying to the public the full fruits of technological progress.

Demand Elasticity and Competitive Price Reductions

Schmalensee and Taylor assert that additional competition in the wideband LMS market would be of little benefit because the price reductions afforded by added competition would be relatively small. They observe that these services have many partial substitutes in the location and monitoring of vehicles and other objects. They point to the Global Positioning System, cellular mobile telephone service, and future PCS systems as examples. Because the demand for LMS services is elastic in the presence of such substitutes, the entry of additional wideband LMS suppliers is likely to have relatively little effect on price.

To demonstrate this point, they include a Figure 1 (at 9) reproduced below as Figure 3.

In their words:

> "In Figure [3], market demand curve A is everywhere more elastic than demand curve B. A new entrant shifts the market supply curve outward from *Supply 1* to *Supply 2*. The increase in quantity elicits a smaller change in market price for demand curve A (*Delta P(A)* than for the less elastic demand curve B (*Delta P(B)*)". (at 9).

To be sure, the differences in price changes in Figure 3 are impressive. But what is actually going on is geometric legerdemain. The relative changes in prices -- the size of Delta P (A) Relative to Delta P (B) -- depend entirely on the slopes of the supply curves. If they had been drawn less steeply, the relative difference between Delta P (A) and Delta P (B) would have been smaller. If they had been drawn as horizontal (indicating that unit costs are constant for all levels of output) the difference would have disappeared altogether.

Moreover, their geometry is inconsistent with their assertion that total capacity, hence total output, falls as the number of firms increases (as a consequence of their iron law of signal detention). In Figure 3, quantity of sales rises instead of falls for both Demand A and Demand B when the supply curve shifts to the right as a reflection of competitive entry.

Finally, Schmalensee and Taylor again neglect to mention the relevance of surplus in all such evaluations. The benefit of adding competition is measured by the increase in surplus, not by the reduction in price alone. Figure 4 is a reproduction of Figure 3, but with the shaded areas added to denote the change in consumer surplus occasioned by the expansion from supply curve 1 to supply curve 2. The consumer surplus associated with Delta P(A) is not obviously smaller than that associated with Delta P(B). Which area is the larger depends on how one draws the curves.[16] Thus, even if Demand A properly reflects the situation faced by wideband

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[16] Producer surplus, the triangular area between the supply curve and the price line, is much larger for Demand A than for Demand B -- an artifact of the way the figures are drawn.

Figure 3

More Elastic Demand Leads to Smaller Price Reductions From Additional Entry

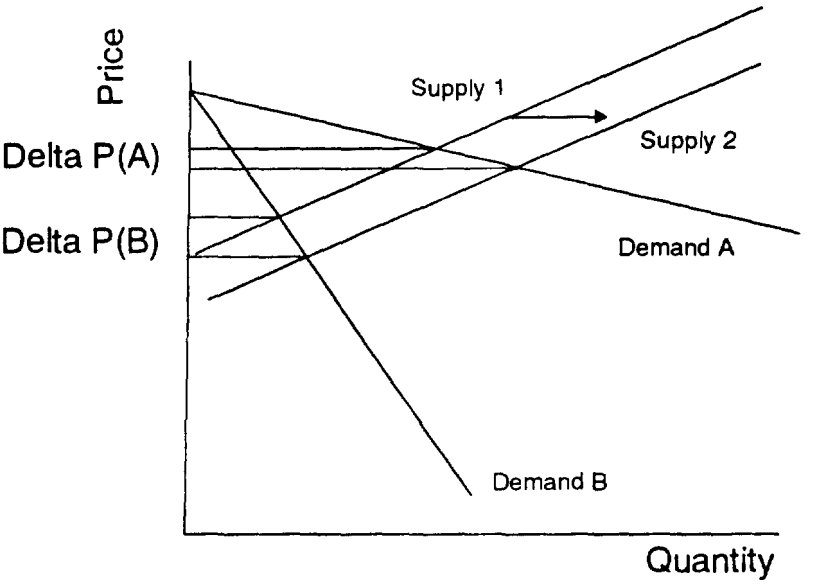
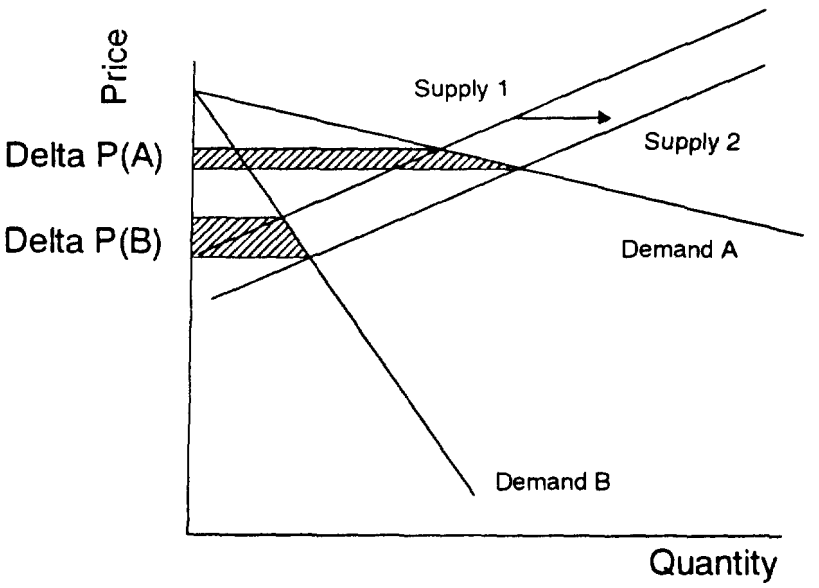


Figure 4

Consumer Surplus is What Counts



LMS systems, the change in consumer surplus -- and the benefit to society -- could be just as great or greater than the benefit to society of additional competition in a market with a less elastic demand, depicted by Demand B.

Moving beyond misleading geometry, we are left with the question of whether the presence of partial substitutes for wideband LMS services provides grounds for arguing in favor of protecting incumbents from additional entry. To answer, let us consider an analogy. Suppose that the proposition is advanced that prohibitive import duties should be levied on facsimile machines on grounds that doing so would encourage domestic manufacturing of these machines and create jobs for American workers. Suppose it is further argued that protection would cause little harm since there are many partial substitutes for facsimile services -- the telephone, E-Mail, electronic file transfers, overnight express delivery, even hand delivery in downtown areas. Consequently, price increases would be constrained by the presence of these substitutes.

Most of us would be skeptical about this argument for at least three reasons: (a) the diversity of consumer tastes for various features offered by the wide array of today's fax machines (speed, convenience, storage capacity, etc.) would be less well satisfied if manufacturing were in the hands of few domestic suppliers, (b) even small price increases would reduce consumer welfare, and (c) protection would facilitate the survival of relatively inefficient firms despite the presence of partial substitutes. While the protection argument would be harder to make in the absence of substitutes, their presence would not make the argument easy to swallow. Similarly for wideband LMS services.

The Appeal of Monopoly in a Schmalensee-Taylor World

Anyone who takes seriously the arguments set forth by Schmalensee and Taylor will be struck by the overriding appeal of monopoly. For the reasons they set forth, a monopoly of wideband LMS services would promise outcomes superior to those we could expect from dividing each geographical market between two firms -- such as Teletrac and MobileVision:

- The monopolist would incur annual operating costs 23 percent below those of a two-firm industry, and 47 percent below those of a four-firm industry.
- Moving beyond monopoly would involve duplication of R&D expenditures, which are necessarily high as shown by Teletrac's experience.
- Cost efficiencies would not be lost since the monopolist has as much incentive to minimize costs as do competitive firms.
- Consolidating sales in the hands of a monopolist would not reduce technological diversity available to the consumer.
- Thanks to the iron law of signal detection, a 16-MHz monopolist would have twice the total capacity offered by Teletrac and MobileVision, each with 8 MHz, and four times the capacity of a four-firm industry.
- Because wideband LMS services have partial substitutes, the monopolist would have rather little leeway to raise prices above competitive levels.
- The empirical economics literature does not offer unambiguous evidence that an increase in the number of firms increases the rate of technological progress.

That Schmalensee and Taylor are themselves uncomfortable with these arguments is suggested by their urging the two-firm solution rather than acceptance of the wideband LMS market as a natural monopoly.

Indeed, Schmalensee has devoted a whole book to describing the nature of natural monopoly and to assessing the variety of ways that natural monopoly may be controlled (or broken up when the monopoly turns out not to be natural) to serve the public interest. Reductions in barriers to competitive entry are among the controls he examines. He concludes: "It would seem desirable at least to shift the burden of proof onto those wishing to bar new competition [emphasis supplied] and to require them to make a case for nonsustainability of efficient pricing."[17]

If the monopoly solution for wideband LMS is deemed unacceptable, as Schmalensee and Taylor would agree, where do we draw the line? Why is the two-firm solution better than three or more? What confidence can we have that enshrining the status quo for wideband LMS services in the Commission's permanent rules would be best for society? The answer lies not in deciding on some precise maximum number of firms, but rather to ask how many firms can reasonably be accommodated within existing spectrum allocations to enable them to test their diverse offerings, and then to rely on the marketplace to determine the nature and number of firms that survive in the long run.

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[17] The Control of Natural Monopolies at 109. He cautions that "in a multiple product setting, the [sustainability] literature indicates the possibility that entry restrictions may be necessary for efficiency" (at 108). Even here, however, he notes that entry restrictions can be defended only under stringent conditions hard to meet in the real world. He concludes that the sustainability literature argues "for a careful case-by-case approach" (Id.). Moreover, the sustainability literature applies to the firm producing multiple products, while the Schmalensee-Taylor paper implicitly assumes a single homogeneous LMS service produced by all firms.

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Telecommunications and Information Policy. Dr. Johnson has most recently evaluated the prospects for direct satellite broadcasting, the use of telephone company facilities, and other means, as competitive alternatives to cable television. He has also examined the economic and foreign trade relations aspects of the development of high definition television for residential, commercial, and military uses. He earlier dealt with issues of (a) regulating international telecommunications in response to a growing competitive market structure, (b) maintaining universal domestic telephone service in response to pressures to increase rates for local service, and (c) the role of compatibility standards in telecommunications competition and innovation. As Associate Administrator for Policy Analysis at NTIA in 1978-79, Dr. Johnson's responsibilities included recruiting staff for a research and analysis office of about 40 staff