Technological Change, Contracting and the First Divestiture of AT&T

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Progress in telecommunication technology has played a major role in the development of the American economy. At the turn of this century, the development of long-distance service aided the integration of regional markets. Today's equipment provides many highways which promote the development of information services.[2]

Technological advancements provide positive, forward linkages with the remainder of the economy. Despite these external benefits, adoption of new processes does not necessarily satisfy the pareto criteria for all users of the network. The welfare of users of existing services may be lowered or raised depending on how the upgrading of the network is financed and the gains from technological progress shared.

Michael Katz and Carl Shapiro describe how a firm may use penetration pricing to develop a sufficiently large customer base for a new, network service.[3] Since rate base regulation provides a mechanism

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[1]Queens College and Graduate Center, City University of New York. The assistance of Sheldon Hochheiser and Alan Gardner of the AT&T Corporate Archive is gratefully acknowledged.

[2]Alfred Chandler, The Visible Hand (Cambridge: Harvard University Press, 1977). For a discussion of the role of telecommunication services in the information age, see Congressional Office of Technology Assessment, Technology and the American Economic Transition: Choices for the Future, 1988.

[3]"Technology Adoption in the Presence of Network Externalities," 94 Journal of Political Economy 822-41 (August, 1986).

which allows a supplier to recover all of its annual accounting costs, the losses incurred during the start-up phase of the technology may be recouped through customers of existing monopoly services.

The extra payments that existing customers may incur in the short-run, could be offset in the long-run if a contractual relationship is established which allows these customers to share some of the benefits associated with prices for the new service above the incremental cost of production during the mature stage of the product cycle.

Identifying the incremental cost of adding a new service to an existing network raises a perplexing issue: Is the incremental cost-of-service the cost of expanding output after the network has been re-engineered to provide the new service, or does the incremental cost include both the cost of upgrading the network and the additional output? The issue arises because new services become possible through the deployment of facilities that are also used to provide existing services. Should the fixed cost of the new technology be recovered through a fixed customer charge, and thereby avoid any departure from marginal cost pricing, or should technological change be treated as a joint cost which is recovered by setting prices that reflect the relative benefits obtained by different customers? Since the new technology is provided in fixed proportions to all customers on the network, it may be argued that pricing based on relative benefits is the economically efficient approach.

The issue of cost-recovery arising from technological change was faced by the telephone industry one-hundred years ago. In 1885,

technology had evolved to the point at which it was possible for the Bell system to introduce a new product, long-distance service. The provision of this new service required an investment in new, costly technology. The procedures used by the Bell System at the turn of the century, and a contract law case that dealt with cost allocation procedures, provide an interesting paradigm for two contracting propositions that are presented in the final section of the paper. These rules establish conditions of exchange which insure that users of current services will be compensated for sponsoring new telecommunication services.

Economies of Scope and Demand Complementarities in the Telephone Industry

The installation of technologically more sophisticated equipment allows a firm to offer new and higher quality services. At the turn of the century, the customer base for long-distance telephone service increased significantly because of the re-engineering of the local telephone network. Until approximately 1892, long-distance service was provided on a separate network. The toll network involved connecting a customer to a switchboard through two wires, known as a metallic loop. Local service, on the other hand, was provided over only one wire (known as a grounded loop). Because of the difference in wiring, each service used a different type of transmitter and switchboard.

Few customers subscribed to both toll and local service. Those who did were usually businessmen who had a need to frequently contact

associates far away. For the majority of telephone users, placing a toll call involved traveling to AT&T's office in a city. AT&T conjectured that this inconvenience was a major reason for the slow growth in the demand for toll service. Consequently, it chose to integrate its toll and local networks. Integration made it easier for customers to receive and send toll calls.[4]

Currently, similar events are transpiring in the telecommunications industry. The demand for information services has not developed as rapidly as some suppliers would like. One possible explanation is that in order to transmit data over the analog network, users have to rely on modems for analog/digital conversion. The modems do not operate at a fast speed, and a lack of standardization of hardware and software protocols may be inhibiting interest in transmitting information over the public switched network. Many businesses have constructed stand-alone communication networks which provide them with quality service that is unobtainable on the public switched network, or expensive if private lines are rented from the telephone company because of the customer specific adjustments which are required. Upgrading the quality of the local exchange companies' facilities for transmission of high speed data and video services may bring these business customers' traffic back onto the public switched network. Businesses may be attracted by the ubiquity of the public

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[4]Testimony of Horace F. Hill, in Read et. al. v. Central Union Telephone Company (hereafter "Read"), Superior Court of Cook County Illinois, Chancery General Number 299,689, p. 3006, 3575-7, 3585-6, American Telephone and Telegraph Company Corporate Archive, Warren, N.J. (hereafter "AT&TCA"); E.J. Hall to T. Vail, May 12, 1885, box 1011, "Building Early Long-Distance Lines," AT&TCA.

switched network, and the desire to limit firm specific investment in communication's equipment and managerial staff.

In order to provide the new services, the public switched network is being redesigned. The first stage involves the installation of new facilities which improve the local exchange companies' (LECs) ability to market high-speed data transmission services (known as integrated services digital network, ISDN). The second stage, known as integrated broadband networks (IBN), requires the deployment of facilities which enable the LECs to supply video, high-speed data and voice services through common facilities.

With ISDN, and long-distance services, and soon with IBN, new technology was deployed which allowed the firm to provide services that were developing slowly under stand-alone systems. The ability to market these new services, is improved through integration with existing services due to both economies of scope and demand complimentarities. How these benefits are shared between services is explored below.

Equity With Technological Change: The 1917 Court Ordered Divestiture of AT&T's Midwest Properties

In 1893, Alexander Graham Bell's telephone patent expired. Almost overnight, competitors of the American Telephone and Telegraph Company (AT&T), known as Independent Telephone Companies, sprung-up around the nation. The Independents were attracted to the industry because of the high profits earned by AT&T during the patent monopoly

period, and because of widespread customer dissatisfaction with the quality of telephone service.

The Independents were the most successful in the Mid-west, and the least successful in the East.[5] The Central Union Telephone Company, AT&T's operating company in Indiana, Illinois and Ohio, fared especially poorly. Not only did it see its market share quickly fall from 100% to less than 50%, it also suspended dividend payments in 1894. Throughout the competitive period, Central operated at a loss.[6]

Despite operating at a loss, Central was able to obtain money from AT&T for expansion and upgrading of its system. AT&T provided the money because it felt that its long-term success would be enhanced through the construction of an integrated, national network. Furthermore, with the advent of competition, AT&T announced that it would respond to competition in a manner similar to Selten's "chain-store paradox." Where entry occurred, AT&T responded aggressively, rather than as a cooperative duopolist. This response was adopted to signal entrepreneurs who were considering entering AT&T's profitable monopoly markets that, after entry, both firms would loose money. Therefore, in order to develop its nationwide network, as well as to protect its monopoly exchanges elsewhere, AT&T had Central Union adopt policies that were in the best interest of its system.[7]

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[5]United States Bureau of the Census, Telephones, Telegraphs and Municipal Signaling Systems: 1912 (Washington: Government Printing Office, 1915), p.35.

[6]Telephone Securities Weekly, April 18, 1907, p.7.

[7]Reinhand Selten, "The Chain Store Paradox," Theory and Decision 9 (1978): 127-59; L.N. Whitney, "Report on Conditions in Indiana," p.3, box 11, Museum of Independent Telephony; and 16 Western Electrician

In the Central Union territory, two important effects of nationwide integration were operating at a financial loss for an extended period of time, and re-engineering the local network to meet the more stringent technical requirements of the long-distance network. AT&T had originally tried to develop long-distance service by constructing a toll, stand-alone network. The clarity of the connection on the grounded loop technology used for exchange calls was inadequate for long-distance calls. The toll network used two wires (a metallic loop) for customer connections. The use of a second wire significantly reduced the level of electrical interference. The annual cost of providing service through the metallic system was approximately $24 per customer, or 35% higher then through the grounded loop technology.[8]

The price of a metallic loop reflected the difference in cost of service. Customers who wanted the new, long-distance service might have to rent the loop at a rate which was approximately $20 to $50 more a year than the price of access to the local, stand-alone network.[9] Few customers, mostly wealthy residential and large business customers,

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(1895) 98, 180, 185 and 186.

[8]T. Sheridan to J. Hudson, November 20, 1895, box 1275, "Maryland Telephone Commission--1895," AT&TCA.
A few years after integration began, the differences in annual operating expenses were negligible. Unsigned memorandum, "Memorandum: Concerning Certain Peculiar Features of Telephone Exchange Service...," September 10, 1901, box 12, "Telephone Rates-Basis-1880-1908," AT&TCA. This may reflect learning-by-doing productivity gains, reduced maintenance costs and that technological research was directed at improvements of metallic, not grounded service.

[9]E.J. Hall to J. Hudson, December 10, 1898, box 1287, "New York City--Rates--Changes in Basis," AT&TCA; and Hall to T. Vail, July 8, 1886, box 1011, "Building Early Long Distance Lines," AT&TCA.

were willing to subscribe to both systems. Therefore, the more common way for a toll call to be completed was for a customer to go to the telephone company's office and use the special equipment that was available there.

The combination of either paying a higher price for a toll line, or the inconvenience of having to visit the telephone company's office in order to place or receive a call, limited the development of toll telephone service prior to approximately 1889. Faced with this retarded development, AT&T's central management decided that the situation could be improved by redesigning the exchange network to meet the more stringent technical requirements of the toll network. Not only would this eliminate the need for a stand-alone, toll network, but on the demand side of the market, it would expand the number of customers who could be reached over the toll lines. This demand-complimentarity was crucial to the success of AT&T's long-distance network. In formulating the plans for the network in 1885, E.J. Hall wrote President Vail that, "The success of the long distance business will be in proportion to our ability to connect existing exchange systems, and our income will be derived mainly from the tolls for that service."[10]

The integration of the two networks met with some internal resistance, and therefore delay. For example, the chief engineer of

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[10]May 12, 1885, box 1011, "Building Early Long Distance Lines," AT&TCA. Three years later, Hall held the same view, but added "that the continued success of the local exchanges will be largely in proportion to their ability to connect satisfactorily with our lines." Hall to Hudson, January 21, 1888, in box 1011, "Building Early Long Distance LInes," AT&TCA.

AT&T's most important local operating company, the New York Telephone Company, argued that integration would raise the cost of providing exchange service. It was not clear that the benefits to the local company from more intensive use of its network, exceeded the incremental cost of upgrading its network.[11]

Many local operating companies shared this concern. They were unsure of the extent to which customers were interested in placing long-distance calls, and the division of toll revenue procedures established by AT&T did not provide sufficient economic incentive which would make it profitable for them to promote the toll service.[12]

On a system wide basis, the benefits likely exceeded the costs. But AT&T's local operating companies received little of the direct benefits associated with upgrading the network. The capital costs of the grounded-to-metallic network upgrade were assigned in total to the local company. AT&T did pay its operating companies a fee for being

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[11]Neil H. Wasserman, From Invention to Innovation: Long-Distance Telephone Transmission at the Turn of the Century (Baltimore: John Hopkins University Press, 1985), p.38-39, 137; and Testimony of James P. Baughman, United States v. American Telephone and Telegraph Company, Civil Action No. 74-1698, filed December 2, 1981, p. 71.

[12]Ibid., p. A-27; E.J. Hall to J.E. Hudson, January 7, 1889, author's file; Chas. J. Glidden to O.E. Madden, May 18, 1880, and W. Whitcomb to American Bell Telephone, May 20, 1880, in box 1210, "Boston-Extra-Territorial Lines--Revenue Allocations--1880;" and Hall to J. Hudson, January 21, 1888, box 1011, "Building Early Long Distance Lines;"

It is not surprising that the local managers were unsure about toll service. As a new, unproven product, the uses and the market were largely undefined. E.J. Hall, one of the primary architects of the long-distance system, stated in 1885 that "it would be impossible for anyone to so forecast the future as to settle all the questions which will arise in a business so entirely novel and containing so many unknown factors..." Hall to T. Vail, May 12, 1885, author's file.

allowed to connect its intercity toll lines to the local switchboard, but this payment did not seem adequate from the perspective of the local companies. It may have covered the additional operating expenses associated with billing and handling toll traffic, but it did not cover the incremental capital expenses.

AT&T did not have 100% control of the local companies when long-distance service was integrated into the local network. Consequently, unless AT&T's payment to the local company, along with any additional revenue received due to demand- complementarity for local service, exceeded the incremental costs, the minority stockholders of the local companies would be financially worse off because of this integration. Even though the parent company's position was improved because of economies of scope and demand-complementarity between toll and exchange service, stockholders of the local company could be worse off.

That this was the situation in the Central Union territory was the claim of a few minority stockholders. In 1913, minority stockholders, holding less than four-percent of Central's stock, filed suit in the Superior Court of Cook County, Illinois, charging that they had been compelled to take on costs which were beneficial to AT&T, and had received few benefits in exchange.

The complainants (Read et. al.) claimed that the decisions made by Central Union's Board of Directors were intended to promote AT&T's national position, and that these interests did not coincide with the short-run interests of the minority stockholders. Read et. al. brought the complaint against AT&T because, in February 1913, after AT&T had defeated the Independents, the parent company attempted to sell Central

Union's properties to other AT&T subsidiaries. The proposed sale price, $29.6 million, was less than the amount owed AT&T for its bond holdings. The purchase price, in effect "would have eliminated the minority stockholders...altogether and made their stock worthless..." The complainants felt that the proposed price for their stock did not reflect the going concern value of the firm, and therefore amounted to confiscation.[13]

For years the market price of Central's stock had been approximately 25 to 50% of its par value. Read et al. felt that the long-term financial problems of the firm had been largely an outgrowth of the competitive war which had been waged on behalf of AT&T, and the construction of a network which best met the interests of its majority stockholder, AT&T. The minority stockholders believed that these sacrifices had been made with the understanding that they would share the future gains.

The court decided the case largely in favor of the complainants. The judge found that AT&T's holdings in the Central Union Telephone Company were made with the intent to monopolize the industry. He also concluded that some of the money loaned to Central was not beneficial to its subsidiary, but was made to help the parent company in its national fight with the Independents. The judge ordered that the cost of the losses incurred due to rate cutting should be born by AT&T, in proportion to the benefits it obtained. The calculation of the

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[13]"Final Decree Entered by Judge William E. Dever," July 10, 1917, in "Read," p. 84. AT&T did offer the minority stockholders three shares of AT&T stock (par $100) for eight shares of Central Union stock (par $100). "Digest of Complaint and of Complainants Principal Affidavits," in "Read," p. A.p.1 (index item 117).

appropriate charge to AT&T was to be made by a court master. The court master was also ordered to take control of AT&T's stock, sell the shares, and then return the proceeds to Bell after the transaction costs were deducted. The court enjoined AT&T from ever acquiring any of the assets of Central Union.[14]

Following the Judge's decision, the parties reached an out-of-court settlement.[15] As a result, AT&T did not have to divest itself of the Mid-west properties. Since the decision was not reviewed by a higher court, we do not know to what extent the history of the American Telephone Industry would have been different if the settlement had not been reached. Nevertheless, the case is of historical importance because the contract law issues addressed in the case persist through today, and they point out some of the potential differences between customer and stockholder rights.

The Read decision may have been upheld by a higher court, because the theory of the case was consistent with contract law: if party A provides party B with a commodity or service under the assumption that party B will provide party A with something in exchange, then it is a violation of the law for party B not to carry out the agreement. In the Read case, the minority stockholders felt that Central Union had been asked to sacrifice current earnings in exchange for future profits. When those future profits were effectively denied them through the exchange of stock, the contract law standard had been

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[14]Ibid., pp. 32-33, 96-102.

[15]N.T. Guernsey to H.B. Thayer, April 10, 1919, box 54, "Central Union--Read Case--Receivership," AT&TCA.

violated.

The stockholders believed that the existing (exchange) network was used to promote the growth of AT&T's nationwide network. Through the synergies of the local and toll system, AT&T's toll lines became profitable. In a sense, the Central Union stockholders were asked to sponsor the growth of Bell's national network. When the gains of the integrated network were not shared, the court found this to be in violation of the law.

There are two sections of the decision that are especially appropriate to today's public policy issues: division of revenue and strategic response to competition. First, regarding cost and revenue allocations, once toll and exchange services were provided through common facilities, AT&T established a standard procedure throughout the nation for the division of toll revenues. Starting in 1891, the local operating company through which the call originated, received a commission of 15%, but not to exceed five cents for any message.[16] The compensation was intended to compensate the local exchange company for the billing and operator costs associated with toll calls.

Read et. al. did not feel that the division of revenue procedure was fair to the minority stockholders of Central Union. They rejected AT&T's argument that the compensation was fair as long as it covered the incremental cost of offering toll service. AT&T's calculation of incremental cost was based on the assumption that a metallic-loop-

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[16]The maximum payment to the operating company was increased to ten cents in 1893. Federal Communications Special Investigation No. 1, "Control of Telephone Communications," v. III, p. 111, June 15, 1937; and Dever, "Final Decree," p. 49.

network already existed. The complainants felt, instead, that they should receive compensation for the use of their facilities:

> [I]t would be unfair to apply the excess cost test theory...that in determining what would be a fair division of the joint revenue derived from this joint business the relationship should be regarded as a partnership, and that the revenue derived from the business should be apportioned to the two companies on the basis of the investment of each company in the property required for the doing of this business and the reasonable cost of operating it.[17]

The court sided with Read, finding that the introduction of toll service through the facilities of Central Union established a "partnership," and that toll revenue should "be fairly apportioned between the two companies in accordance with the cost to each of operating the business, and the capital investment of each company in the lines, equipment and apparatus actually used in connection with said business."[18]

Read et. al. also asked the court to order compensation for costs Central incurred as part of AT&T's national response to competition. As mentioned above, where it faced direct competition, AT&T responded aggressively. It did this in order to establish a reputation as an non-cooperative duopolist. Reputation can be an effective means of deterring entry, and AT&T's managers believed that this was a sensible

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[17]"Opinion Rendered by Judge William E. Dever," January 20, 1917, "Read," p. 110-11. In the parlance of telephone separations' procedures, the complainants rejected AT&T's board-to-board theory, and instead subscribed to the station-to-station theory. Peter Temin and Geoffrey Peters, "Cross-Subsidization in the Telephone Network," 21 Willamette Law Review (1985), p. 201.

[18]Dever, "Final Decree," p.49. AT&T was ordered to compensate the complainants on "a fair and equitable" basis for the toll calls handled by Central Union between 1891 and 1917. Ibid., p. 106.

strategy to follow after the expiration of Alexander Graham Bell's patent in 1893.

As the Mid-west was the area of the country in which its rivals were strongest, an aggressive response could be quite costly to the local operating companies, depending on how the cost of this strategy was shared. According to the complainants, the burden of this strategy was absorbed by the stockholders of the local operating company. Read felt that compensation should be given to Central's minority stockholders, otherwise they would have incurred costs that were beneficial to AT&T, without receiving compensation. AT&T argued on the other hand, that the expenditures incurred by Central during the competitive era were imperative to its own survival.[19]

The court sided with Read, finding that Central had absorbed the "whole burden of the fight against competition." Judge Dever felt that if not for AT&T's objective to control the national market, Central Union would have adopted a more cooperative position to entrants:

> [T]hat had the Union and American Companies been acting independently of each other under the same conditions as actually existed in Union Company territory, it is not conceivable that the Union Company's officials would have permitted that company to have borne the full burden of this expensive fight; that in the interest of its stockholders the officers of the Union Company might have restricted the field of its operations rather than expanded it, and the court holds that thereby competition could have been met in limited territory without loss or impairment of the Union Company's capital...[20]

Since AT&T benefited from Central Union's aggressive response to

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[19]"Brief and Argument for Appellant, American Telephone and Telegraph Company," March 1918, "Read," p. 278.

[20]Dever, "Final Decree," p.74

competition, the Court ordered that AT&T share the associated costs based on "the extent to which it benefited thereby."[21]

A principle theme running through Judge Dever's decision was that Central Union had adopted policies that were in the best interest of its majority stockholder, AT&T, but "against the interests of the minority stockholders." Because the benefits of Central's policies mostly accrued to AT&T, while the costs were largely absorbed by the license Company, the "dealings" were "set aside [at] the instance of [the] nonassenting [minority] stockholders.[22]"

Central Union had helped sponsor the growth of AT&T's integrated, nationwide system, but was denied the opportunity to share in the benefits because of the contracting terms imposed by AT&T, and by the terms of sale considered by the licensee's board in February 1913. Since AT&T had abused its fiduciary relationship with minority stockholders, the complainants were entitled to court ordered compensation. Judge Dever ordered that relative benefits of joint undertakings be used as the method to determine the appropriate allocation of joint costs. The judge decreed that a court master should review "the contracts, dealing and transactions" between Central Union and AT&t that were issue in the case, and

> that in so far as any funds of said Union Company were used for the joint benefit of the American Company and the Union Company the master shall apportion the amount which is chargeable to each of said parties upon a fair and equitable basis, having regard to the benefits resulting to said companies respectively from the expenditures made for their

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[21]Dever, "Final Decree," p. 76.

[22]Dever, "Final Decree," p. 38.

joint benefit...[23]

Today, a similar issue arises with the development of the information age infrastructure. There are many medium which can be used to provide high-speed data and video services. The market position of the LECs will be improved if data and video services are integrated with existing voice telephone services. Depending on the contractual terms established by regulatory commissions, the welfare of customers of voice telephone service can be raised or lowered by sharing facilities with video and data services on an integrated broadband network (IBN). In the next section of the paper, two contracting propositions are discussed that could be used to resolve the issue of recovering the joint costs of the information age infrastructure.

Contracts

A Pareto Efficient Outcome

A supplier must decide whether to employ low or high level technology. While two products, X_L and X_H, can be provided with the high level technology, only X_L can be provided by the less expensive facilities. The firm and the regulatory body must decide how to recover the costs of equipment shared by both products. Let θ_i be a technology parameter where i = L or H. $\theta_H > \theta_L$.

L = Low level technology

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[23]Dever, "Final Decree," p. 103 (first quote), and p. 104 (second quote).

H = High level technology

X_i = quantity supplied of high/low level quality product

P_i = price of product X_i

$C(X_L,\theta_L)$ = cost of producing X_L with technology θ_L

$C(X_L,X_H,\theta_H)$ = cost of jointly producing X_L and X_H with technology θ_H

The cost function is strictly increasing in θ and X_i.

Non-negative profits of the firm implies

(1) $P_LX_L \geq C(X_L,\theta_L)$ and

(2) $\Sigma P_iX_i \geq C(X_L,X_H,\theta_H)$

$R(X_i,\theta_i) = P_iX_i$ = revenue from product X_i when technology θ_i is employed.

The incremental cost[24] of providing the high quality service is:

(3) $IC_H=C(X_L,X_H,\theta_H)-C(X_L,\theta_L)$. Where $IC_H < C(X_H,\theta_H)$. The strong inequality reflects that, by assumption, there are economies of scope. The presence of these economies of scope create an economic incentive for the consumers of X_H to join a coalition with the consumers of X_L. Let $P(X_i,\theta_i)$ be the inverse demand function of the consumers. P() is strictly increasing in θ and strictly decreasing in X_L. θ enters the demand function because customers are willing to pay more money for a high quality product. Consumers buy either X_L or X_H, but not both products.

A coalition is beneficial for those consumers who buy only X_L if

$CS(X_L,\theta_L)= \int_0^X P(v_L,\theta_L)dv_L - R(X_L,\theta_L) < \int_0^X P(v_L,\theta_H)dv_L - R(X_L,\theta_H) = CS(X_L,\theta_H)$. $CS(X_L,\theta_H)$ is the consumers surplus obtained by consumers of

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[24]Gerald R. Faulhaber, "Cross-Subsidization: Pricing in Public Enterprises," 65 American Economic Review (December 1975), p. 969.

X_L when they form a coalition with X_H.

The supplier and the regulatory body's pricing options are determined by the demand parameters (which largely reflect the availability of substitutes). Which option they choose is largely determined by their objective function.

Proposition One: The regulatory body should approve tariffs and investments which are Pareto Efficient and satisfy the non-negative profits constraint. For the low quality customers, the Pareto constraint means

$$(4)\quad \int_0^{\lambda} P(v_L,\theta_L)dv_L - R(X_L,\theta_L) \leq \int_0^{\lambda} P(v_L,\theta_H)dv_L - R(X_L,\theta_H).$$

Rearranging terms, proposition one is equivalent to stating that $R(X_L,\theta_H) - R(X_L,\theta_L) \leq \int P(v_L,\theta_H)dv_L - \int P(v_L,\theta_L)dv_L$. That is, the incremental revenue obtained from customers of X_L is less than, or equal to, the maximum additional amount of money consumers are willing to pay for the product after quality is increased.

Proposition One can be interpreted as a regulatory standard which protects customers who may otherwise be hurt by technological change. Jonathan Hughes argues that this has been the underlying rationale for much of the regulation enacted in the United States.[25] While the Pareto condition seems to be rather a trivial objective, there is no assurance that it will be achieved unless it is established as a standard. The extent to which the firm will select prices that meet this condition is determined by the elasticity of demand for its products.

We can interpret Proposition One as a pricing rule which would

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[25]Jonathan Hughes, The Government Habit (New York: Basic Books, 1977).

emerge in a contestable market. Consider the case in which there is a high elasticity of demand for X_L because alternative systems can be easily constructed. Proposition One would be met if the market were contestable, because customers of X_L will construct a stand-alone system unless:

(5) $R(X_L,\theta_H) \leq C(X_L,\theta_L) + \int_0^{\lambda} P(X_L,\theta_H)dv_L - \int_0^{\lambda} P(X_L,\theta_L)dv_L$.

If the market were contestable, $R(X_L,\theta_L) = C(X_L,\theta_L)$. Rearranging terms in (5), and substituting for $C(X_L,\theta_L)$, we obtain Proposition One. We see, therefore, that Proposition One is consistent with one of the objectives of regulation, emulation of competitive market behavior.

Sharing the Gains From Forming a Coalition

Proposition One does not require that the welfare of consumers of X_L be increased by forming a coalition with X_H. The Proposition merely requires that the customers who have less stringent quality requirements be no worse off. Under Proposition One, all of the gains from forming a coalition can accrue to the firm or the customers of the new service.

We have seen that with the introduction of long-distance telephone service, the profitability of that service was increased by joining a coalition with exchange customers. The Court found in Read that the post-coalition forming profits earned by toll service should not all be retained by AT&T. Instead, they were required to share the gains with their sponsor--the minority stock holders of Central Union.

Presently, a similar issue exists regarding the development of integrated broadband networks (IBN). On a stand-alone basis, ISDN and

IBN services are not profitable today. The known demand for high-speed data and video is not sufficiently large to justify the capital investments being made by the local exchange companies. Instead, the suppliers are hoping that, as with long-distance telephone service at the turn-of-the-century, that once a critical mass is obtained, the demand for the service will take-off.

Until the demand for the service takes off, customers of voice telephone service, X_L, are paying higher prices than they would pay in the absence of the introduction of X_H. The introduction of X_H requires the accelerated retirement of existing equipment.[26] Since depreciation

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[26]The following passage from Michigan Bell Telephone's 1983 Depreciation Report to the Federal Communication Commission illustrates the factors the firm feels is forcing it to increase its depreciation rates:

> The ability to switch high speed data at a variety of speeds is essential. Processor retrofits and generic updates will only provide intermediate relief to the growing network demand. In the short term, use of multiple systems to perform additional switching functions like video, seems reasonable. But as demand on the network expands, the multiple switch concept will become too expensive to maintain. Instead of having three switching units in a central office, one for POTS (Plain Old Telephone Service), another for data and a third for video, it will be more economical to place a multiple purpose switch. p. 6.

In 1977, the firm's depreciation rate for electronic, analog switching machines was 2.7%. In 1986, the firm requested that the rate be increased to 17.3%.

The Regional Bell Operating Companies have not needed to turn to the capital markets in recent years for financing of IBN and ISDN, in part, because the financing is being generated internally through accelerated depreciation rates. Bruce L. Egan, "Phone Companies Are Businesses Too," Columbia University Center for Telecommunications and Information Studies, Autumn 1988.

The composite depreciation rates of telephone companies has increased from 5.1% to 7.4% between 1975 and 1986. National Association of Railroad and Utility Commissions' Capital Recovery Task Force, March 9, 1988, pp. 2-3. Depreciation is the local exchange companies' largest operating expense. 1986 Federal Communications

expenses are largely based on the expected life of the equipment, this acceleration increases the annual expenses which are recovered in the prices authorized by regulatory commissions. Even though P_L may be higher in the short-run, the welfare of customers of X_L may be higher or lower over the life cycle of X_L, depending on how they are compensated for sponsoring X_H.

If recent regulatory trends are instructive, customers of X_L will not be compensated for sponsoring the new services. During the past ten years, it has increasingly become a regulatory practice to deregulate new and enhanced services.[27] Even though these new services, X_H, often share the same facilities, they are treated as a service provided by a non-regulated subsidiary. The separation of costs between the regulated and non-regulated subsidiary is often based on relative use, or the short-run incremental cost of using common facilities.[28] These methods do not take into account the cost impact of θ_H. Neither does either method take into account the costs X_L incurred sponsoring X_H.[29]

Commission Statistics of Communication, Table 14.

[27]Deregulation, on the surface, seems sensible because the new services are not essential and alternative suppliers serve the market.

[28]The short-run incremental cost is calculated as follows: $C(X_L,X_H,\theta_H) - C(X_L,0,\theta_H)$. Unlike in equation (3), it is assumed that X_L would use θ_H on a stand-alone basis.
For a discussion of the mechanics of the relative-use procedure, see "Separation of Costs of Regulated Telephone Service From Costs of Nonregulated Activities," CC Docket no. 86-111, 2 Federal Communications Commission Record (1987) p. 6283.

[29]For a discussion of the cost allocation incentives faced by the multi-product firm, see James Thomas Hannon, "The Impact of Competition on Cost Allocations in A Multi-Market Monopoly: Telecommunications," unpublished Ph. D. Dissertation, University of Illinois--Urbana, 1978.

If the customers of X_L were treated on the same basis as the minority stockholders of Central Union, benefits and investments, not narrowly defined "incremental costs," would be the basis of the separating costs and/or assigning the gains from forming a coalition. The over assignment of costs to X_L can only be achieved because the market is not contestable (see Proposition One). Proposition Two proposes that customers of X_L share the gains from forming a coalition, just as the court found in Read.

Proposition Two

If the gains from forming a coalition are to be shared by customers of X_L and X_H, and if (2) holds with strict equality, revenue from each customer class must meet the following conditions:

(6) $IC_H - [R(X_L,\theta_H) - R(X_L,\theta_L)] = R(X_H,\theta_H) < C(X_H,\theta_H) < \int_0^{X} P(v_H,\theta_H)dv_H$

(7) $C(X_L,X_H,\theta_H) - R(X_H,\theta_H) = R(X_L,\theta_H) < C(X_L,\theta_L) + [\int_0^{X} P(v_L,\theta_H)dv_L - \int_0^{X} P(v_L,\theta_L)dv_L]$

Proposition Two defines the core which is mutually beneficial to subscribers of X_L and X_H.[30] Prices are set so that both groups of customers receive a higher level of utility in the coalition then they

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Hannon shows that a multi-product firm which operates in an unregulated and regulated market will be able to increase its profits "by continually allocating more costs to the regulated sector until the point is reached where the regulatory constraint becomes ineffective with further cost assignments." The firm does not favor a further increase in costs allocated to the regulated monopoly market once the absolute value of the decline in profits in the regulated market exceeds the increase in profits in the unregulated market. pp. 172 (quote), 49.

[30]Equation (4) is equivalent to equation (7) except for the use of a weak inequality sign in the latter equation. The weak inequality requires that the welfare of customers of X_L increased after the coalition is formed. Equation (4) only required that they be no worse off.

would obtain on a stand-alone basis.

Proposition Two suggests that customers of X_L should share the economies of scope and be compensated for sponsoring X_H. Some of the product development expenses associated with X_H have been paid for by the customers of X_L. The welfare improvement by X_L under Proposition Two results from an implicit contract treatment which is equivalent to the compensation provided to the minority stockholders of Central Union.

The party which receives the greatest benefits from the economies of scope is determined through the cost-allocation and price-setting process. Suppose that these new services are deregulated. If the standard adopted in the Read Case was applied to ISDN and IBN, the sharing of benefits could mean that the profits obtained from X_H, once the service is priced above incremental cost, would be shared with customers of X_L. Profits could be split based on the percentage of product development costs paid by X_L.[31]

This first sharing mechanism is based on investments and expenditures--the traditional method of determining compensation of rate-base regulated firms. This method was adopted by Judge Dever for the allocation of toll revenue in the Read case. Dever also proposed that expenditures which benefited both local and toll service be allocated between AT&T and Central Union, "upon a fair and equitable

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[31]These costs include, but are not limited to, marketing, research and development, fixed capital, legal, maintenance, and strategic planning expenditures.

Implementation of this proposal requires that regulatory commissions have access to the records of the suppliers' books. When this involves review of non-regulated subsidiaries' accounts, serious implementation problems may arise.

basis, having regard to the benefits resulting to said companies respectively..."[32] If this standard were used to determine the compensation due POTS for sponsoring ISDN and IBN, regulators would need to know the demand curve for the new services. The demand associated with the provision of new services made possible by technology θ_H is uncertain. Suppliers and regulators have, at best, a weak sense of how consumers will value the new services.[33]

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[32]Dever, "Final Decree," p. 104.

[33]There is a widespread consensus in the industry that little is known about the demand for ISDN and IBN services. For example, N. Curren and M. Gensollon write that "In contrast with the analysis of supply, which has to be carried out by persons with the necessary technical knowledge; nobody is recognized as being specially qualified to talk about demand..." "Determining Demand for New Telecommunication Services," in Trends of Change in Telecommunications Policy (Paris: Organization for Economic Cooperation and Development), p. 137 (no editor).

The Federal Communications Commission recently proposed that telephone company usage forecasts be used to allocate the cost of new investment between regulated and non-regulated services. The allocation of common equipment was to be based on relative use during the period at which the nonregulated use was at its highest occupancy rate during the equipment's life cycle. After public notice, the Commission instead chose to base cost allocations on only three-year demand forecasts. The suppliers of the new services had informed the Commission "that they cannot forecast relative nonregulated and regulated usage over the lengthy depreciation lives of most network plant." "Separation of Costs of Regulated Telephone Service From Costs of Nonregulated Activities," CC Docket no. 86-111, 2 Federal Communications Commission Record p. 6283.

The suppliers claim that they are unable to accurately measure the demand for information and video services is not unlike the AT&T's position with regard to long-distance service in 1885. One crucial difference between today and 1885 is that the local exchange companies are now regulated. For a discussion of optimal pricing rules when the firm, but not the regulator, observes the intensity of demand, see Tracey Lewis and David Sappington, "Regulating a Monopolist with Unknown Demand," 78 American Economic Review 986-998 (December 1988). Lewis and Sappington conclude that where the cost function of the supplier exhibits decreasing marginal costs, "no pricing authority [should be] delegated to the firm. The regulator [should] us[e] his own imperfect information exclusively to establish the regulated price." p. 996.

Demand forecasts can and must be made by the supplier prior to introducing the new technology. Nevertheless, it is not possible for regulators to verify independently the veracity of the projections. The forecasts are often conducted by market researchers who segment the market and attempt to determine the willingness to pay of different groups. Regulatory bodies do not have the resources, or the presence in the market, to undertake this type of research.

In the absence of knowledge of the inverse demand function for X_H, sharing factors could also be developed through cost simulation based on different demand scenarios. Forecasts for new and existing services are available and they may be used as a basis for sensitivity analysis. The results of the cost study can be used to derive mutually beneficial allocations (in the core) by employing the Moriarty rule, for example.[34]

Conclusion

Minority stockholders are provided protection by the courts in order to insure that decisions made by the firm's directors are in the best interest of all stockholders, not just the majority. Court protection is provided because the minority stockholders do not have veto power within the firm. Neither do the monopoly customers of the regulated local exchange companies have veto power over the upgrading of the telecommunications network. Are these customers entitled to the

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[34]S. Moriarty, "Another Approach to Allocating Joint Costs," 50 Accounting Review (1975), pp. 791-95.

same protection as stockholders? If customers were not currently funding the development of new services, the local exchange companies would have to raise the money for upgrading through capital markets. The higher rates being paid today by customers of voice telephone service suggest that they are, in essence, stockholders and should be afforded the same protection provided to the complainants in Read. To require some form of mutually beneficial contracting is one way of providing the same type of protection to captive customers which is available to minority stockholders.

Regulatory bodies are using depreciation rates as a means to fund the construction of America's information age infrastructure. Unfortunately, there is little explicit recognition that this is what is occurring. If all parties would recognize that the accelerated depreciation of equipment makes a contribution to the nation's infrastructure, and that rate payers are contributing to that development, a contracting mechanism may be worked out which is mutually beneficial. Conceivably there could be less opposition to increases in Commission authorized depreciation rates if rate payers were rewarded for their investment in the infrastructure in the same manner as traditional stockholders.