

Retrospectives

The Marginal Cost Controversy

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This feature addresses the history of economic terms and ideas. The hope is to deepen the workaday dialogue of economists, while perhaps also casting new light on ongoing questions. If you have suggestions for future topics or authors, please write to Joseph Persky of the University of Illinois at Chicago at jpersky@uic.edu.

Introduction

From 1938 to 1950, there was a spirited debate about whether decreasing-average-cost industries should set prices at marginal cost, with attendant subsidies if necessary. In 1938, Harold Hotelling published a forceful and far-reaching proposal for marginal cost pricing entitled “The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates.” After several years and many pages of discussion, Ronald Coase gave a name and a clear formulation to the debate in his 1946 article “The Marginal Cost Controversy.” We will tell much of the story of this controversy by comparing the frameworks of Hotelling and Coase, while also bringing in other contributors and offering some thoughts about contemporary relevance. The arguments marshaled by Coase (and his contemporaries) not only succeeded in this particular debate, as we shall see,

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but more generally served as part of the foundation for various fields of modern economics, particularly institutional, regulatory, and public choice economics as well as law and economics. Yet the underlying issues are quite difficult to resolve, and the strengths and weaknesses of the arguments for marginal cost pricing can turn on specific elements of the industry.

The Case for Marginal Cost Pricing

The origins of the marginal cost controversy can be traced back to a discussion in Book V, Chapter XII of Alfred Marshall's (1890) *Principles of Economics* (as explained in Ruggles 1949a). Marshall pointed out that in what he called an "increasing returns" industry—in which marginal costs of production were falling at the quantity relevant to market demand—having the government paying a "bounty" (a subsidy) to the producers could benefit consumers. The bounty would shift out the supply curve, which with declining marginal costs would bring down the price, thus expanding consumer surplus. Marshall wrote: "[A] bounty on such a commodity causes so great a fall in its price to the consumer, that the consequent increase of consumers' surplus may exceed the total payments made by the State to the producers; and certainly will do so in case the law of increasing return acts at all sharply."

Indeed, Marshall offered a further illustration that J. H. Clapham (1922) famously challenged as an "empty economics box." Marshall showed a graphical example in which a revenue-neutral combination of a tax on an increasing-marginal-cost industry combined with a bounty for a decreasing-marginal-cost industry could raise consumer surplus. A. C. Pigou, Allyn Young, J. H. Clapham, Knight, and others argued over this result until Clapham and then Knight pointed out that with static technology, the decreasing-marginal-cost industry was not creating a positive externality, but merely benefitting from internal economies of scale in related firms. Thus, there was no market failure and Marshall's tax-subsidy scheme would not actually increase welfare. By the 1930s, this controversy was dying down, and economists turned away from industry-level decreasing costs to internal decreasing costs at the firm level. In particular, a common focus was the example of large firms with high fixed costs and low marginal costs, like railroads. In such industries, the average cost of production was declining over a substantial range of output, with the low marginal costs falling below the average costs over that same range of output. As a result, a price set equal to marginal cost would not cover the average cost of production, and would cause a firm to sustain losses.

Hotelling (1938) brought many of these arguments together.¹ He appealed to the basic economic intuition that efficiency requires marginal cost pricing because

¹ Ruggles (1949a) describes how Hotelling's (1938) essay built on a number of slightly earlier works. For example, Dickinson (1933) retained the old idea about taxing increasing-marginal-cost industries and introduced the criterion of pricing at marginal cost for decreasing-marginal-cost industries. Abba

it fulfills the efficiency condition that social welfare will be greatest when marginal benefits (as captured in the price consumers are willing to pay) are equated to marginal costs. Hotelling argued that “the optimum of the general welfare corresponds to the sale of everything at marginal cost” and that general government revenues should “be applied to cover the fixed costs of electric power plants, waterworks, railroad, and other industries in which the fixed costs are large, so as to reduce to the level of marginal cost the prices charged for the services and products of these industries” (p. 242).

What about the concern that setting price equal to marginal cost would not allow these industries to cover their fixed costs and thus would force them to sustain losses? In the jargon of the day, a project that generated the revenue to cover its fixed costs was said to be “self-liquidating.” Hotelling (1938) wrote: “The notion that public projects should be ‘self-liquidating,’ on which President Hoover based his inadequate program for combatting the oncoming depression, while attractive to the wealthier tax-payers, is not consistent with the nation’s getting the maximum of satisfactions for its expenditure” (p. 260).

Thus, Hotelling (1938) suggested that government subsidization of the fixed cost component would enable marginal cost pricing for industries with high fixed and low marginal costs. Where would the government obtain the needed revenue for the necessary subsidies? Hotelling refers back to Jules Dupuit’s (1844) result that excise taxes cause what we now call deadweight loss, indeed that the deadweight loss is proportionate to the *square* of the tax rate. Hotelling proved the result mathematically using a consumer’s utility maximization problem and commented, “[I]f a person must pay a certain sum of money in taxes, his satisfaction will be greater if the levy is made directly on him as a fixed amount than if it is made through a system of excise taxes which he can to some extent avoid by rearranging his production and consumption” (p. 252).

Having established the superiority of lump-sum taxes, Hotelling (1938) pointed out that excise taxes have the same undesirable traits as markups above marginal cost. Whether the reason for a markup above marginal costs is an excise tax, the need to recover fixed costs, or pure market power, the result is the same: deadweight loss and a lower level of social welfare. Thus, government revenue should come from lump-sum taxes, which could be used both to abolish excise taxes and to provide any needed subsidies to enable marginal-cost pricing. Hotelling mentioned five potential sources of these lump-sum, nondistortionary taxes: land, on-peak railway trips, advertising (because he claimed total time available for viewing advertising is fixed), inheritance, and income. All five suggestions were controversial, although thinking of an income tax in lump-sum terms probably proved the most contentious at the time. However, as Nancy Ruggles (1949b)

Lerner (1934) then stated that maximum social welfare occurs when a monopolist sets price equal to marginal cost, and R. F. Kahn (1935) extended this to say that assuming equal marginal utility of income, maximum welfare implies subsidizing decreasing-average-cost firms to enable marginal cost pricing.

noted, Hotelling's suggestions were actually fairly conservative and careful by the standards of the time, when other advocates of marginal cost pricing were often taking more radical positions involving nationalization of firms and extensive wealth redistribution.

When Prices Don't Include Opportunity Costs

Coase (1946) challenged Hotelling (1938) and others taking a similar position on the benefits of having marginal cost pricing with government subsidies to cover fixed costs in an industry with declining average costs. Coase (1946) expressed surprise that "despite the importance of its practical implications, its paradoxical nature, and the fact that there are many economists who consider it fallacious, it [the Hotelling proposal] has so far received little written criticism" (pp. 169–70). Coase acknowledged that when price is not equal to marginal cost, there is an efficiency loss. However, he wrote that Hotelling's proposal would "bring about a maldistribution of the factors of production, a maldistribution of income and probably a loss similar to that which the scheme was designed to avoid" (p. 180).

Coase (1946) began with an "isolation of the problem" that helped to clarify the issues. He set up the discussion in this way (p. 170):

The central problem relates to a divergence between average and marginal costs. But, in any actual case, two other problems usually arise. First, some of the costs are common to numbers of consumers and any consideration of the view that total costs ought to be borne by consumers raises the question of whether there is any rational method by which these common costs can be allocated between consumers. Secondly, many of the so-called fixed costs are in fact outlays which were made in the past for factors, the return to which in the present is a quasi-rent, and a consideration of what the return to such factors ought to be (in order to discover what total costs are) raises additional problems of great intricacy.

As a conceptual simplifier, Coase introduced a scenario where there is a central market from which a carrier can make a radial journey, bringing any quantity at one fixed cost. Thus, the marginal cost of carrying an additional quantity is zero, even though there is a positive fixed cost. Coase argued that in the radial market, a Hotelling-style approach to marginal cost pricing would lead to a price of zero for carriage, with the government subsidizing the fixed costs. In this example, Coase noted three problems with the Hotelling scheme.

First, a violation of pricing principles seems to arise. If prices are set at marginal cost while fixed costs are subsidized, then both consumers and producers will not be taking fixed costs into account in their decision-making. Consider a situation in which a producer might either make something on-site, or instead purchase that

input in the center of the radial market and have it transported at a price of zero. Coase (1946, pp. 172–73) argued that the governing rule for optimal pricing, specifically that “the amount paid for a product should be equal to its cost,” must include the opportunity cost of factors. As Coase (1947) wrote in a follow-up essay: “If certain factors of production can be obtained free in one use (because they do not enter into marginal cost) but have to be paid for in another use (because they enter into marginal cost), consumers may choose to employ these factors in the use in which they are free even though they would in fact prefer to employ them in some other way” (p. 150). In the radial market scenario, if carriage is provided freely, a wedge will arise between prices and total costs that distorts consumer decision making and would lead to a “maldistribution of the factors of production between different uses” (p. 174).

A second concern is that government payment for carriage is only justified if consumers would have been willing to pay the full cost. But how can anyone know if that condition holds if carriage is not priced? This brings up the issue of how to know what fixed costs the government should be subsidizing when everything is priced at marginal cost—a question we take up in the next section.

The third concern Coase (1946) pointed out in the radial scenario is that if everyone pays the same price for carriage, there will be redistribution of wealth from high-density (usually urban) users of infrastructure who would otherwise have benefitted from low fixed costs per user toward lower density users who in some other arrangement would have paid much higher fixed costs per user.

Coase (1946) argued in favor of multi-part pricing because it allows the consumer to be charged separately for products (units purchased) and for carriage of products from the central market—that is, in two parts. Coase was not especially clear about how the multipart price might be determined. While the radial market avoids certain kinds of complexity, he admits that it also assumes away the key difficulty of *common* costs of carriage. Coase (1947) advocated cost-based differential pricing rather than value-based price discrimination and criticized Nordin (1947) for misreading his work to conclude that he favored value-based price discrimination. But he never fully addressed the problem of allocating common costs that have no obvious relationship to a particular customer.

Coase (1946) also argued that even average cost pricing can have advantages over marginal cost pricing. On the negative side, it does cause deadweight loss relative to marginal cost, and it does not provide a full test of overall willingness to pay. But avoiding the need for taxes may offset these inefficiencies. Also there is no need for government estimates of demand. Coase argued that these tradeoffs suggest that there should be no presumption in favor of marginal cost pricing. Overall, Coase argued that some form of multipart pricing could allow for average cost recovery while minimizing distortions from pricing above marginal cost. This multi-part pricing alternative (typically involving a fixed fee and a per-unit fee) would retain some degree of market-based demand signals, allow consumers to choose rationally how to spend their money, and generate better information to guide infrastructure investments on the supply-side.

Investment Tests

Subsidized marginal cost pricing—which can be understood as subsidies directed at fixed costs—eliminates or at least truncates signals about demand for infrastructure, significantly reducing the information available for investment decisions about how much infrastructure to build, where to build it, when to add capacity, and so on. With marginal cost pricing and a government subsidy that covers fixed costs, users do not receive a signal of the total cost of the good, and producers do not receive information about willingness to pay for the full cost of new goods or improvements. Under this condition, how will society make decisions about planning and investment in infrastructure markets, including yet-to-be-discovered and discovered-but-yet-to-be-built infrastructure markets?

Hotelling (1938) alluded to this investment test critique. He began by saying: “Determination whether to build the bridge by calculation merely of the revenue $\sum p_i q_i$ obtainable from tolls is always too conservative a criterion” (p. 248). He ended with a brief discussion of how to decide whether something new should be built. For the case of the railroads, Hotelling stressed that they are already built and so this question is moot: “Whether it was wise for the government to subsidize and its backers to construct the Union Pacific Railroad after the Civil War is an interesting historical question which would make a good subject for a dissertation, but it would be better, if necessary, to leave it unsolved than to ruin the country the Union Pacific was designed to serve by charging enormous freight rates and claiming that their sum constitutes a measure of the value to the country of the investment” (p. 268). As for future construction, Hotelling waved at the problem by saying that willingness to pay becomes a problem for “economists, statisticians, and engineers, and perhaps for a certain amount of large-scale experimentation . . .” (p. 269).

That rather blithe attitude toward the investment test touched off a great deal of criticism. Wilson (1945) objected that there was no general test of whether investment was justified—thus making future plans difficult. Coase (1946) argued that in his radial market example, government carriage is only justified if consumers would have been willing to pay the full cost. But how can anyone know if consumers would have been willing to pay that price if carriage is not priced? Relying on the government to subsidize the fixed cost component in decreasing-cost industries raises significant concerns about institutional competence. How will the government know when and who and how much to subsidize? How will the government determine what costs constitute the fixed costs?

From a static efficiency perspective focused exclusively on an already existing public utility, the Hotelling (1938) argument for marginal cost pricing has some clear merits. But when considering a dynamic perspective over time and a range of potential products, Coase (1946) argued that the case for government to pay for fixed costs seems weaker. He expressed skepticism that government would be able to ascertain individual preferences about the appropriate level of fixed costs to subsidize. Indeed, Coase suggested that if government could do so as needed to effectuate Hotelling’s proposal, then there would be little need for markets and the pricing system in general.

In this and other writings, Coase was skeptical of rote confidence in government institutions, and he challenged economists to evaluate critically claims that relied on the expertise, competence, benevolence, and public-mindedness of government officials.

The General Equilibrium Critique and Redistribution Issues

Relying on the government to subsidize fixed costs also raises concerns about distortions caused by government taxation. Coase (1946) maintained that the impact of increasing income or other taxes to raise revenue would be substantial and could not be ignored. Similarly, while Abba Lerner (1944) favored Hotelling-style marginal cost pricing, he insisted that labor market effects of income taxation must be taken into account. This critique concerns general economy-wide distortions originating from taxation.

A Hotelling-style reliance on government taxation and spending also raises concerns about interpersonal comparisons and redistribution of wealth from the general population to public utility consumers. As Pegrum (1944) noted, consumers who benefit under the scheme were not necessarily identical to the taxpayers who paid for the fixed costs.

Hotelling (1938) addressed this question by pointing out that the public policy issue is not whether a single decreasing-cost firm should have its fixed costs subsidized, but whether a large number of such firms would be treated in this way. In any given case, some consumers would benefit more than others. But Hotelling argued: "A rough randomness in distribution would be ample to ensure such a distribution of benefits that most persons in every part of the country would be better off by reason of the programme as a whole." Coase (1946) responded by arguing: "But this argument stands or falls by the assumption that there will be no significant redistribution as between consumers of different kinds of products. There is no reason to assume that this will be so. . . . It would be possible to appraise the character of the redistribution only after a detailed factual enquiry. . . . I see no reason to suppose that there would not be some redistribution, possibly very considerable, as a result of this policy if it were generally applied."

Ruggles (1949b) both summarized various aspects of the earlier debate and made an important contribution that distills two potential general equilibrium problems with the Hotelling proposal: 1) taxes to fund subsidies would violate some marginal conditions, typically on the labor–leisure tradeoff; and 2) income would be redistributed, hence forcing interpersonal comparisons of utility. She argued that these objections are not fatal to a Hotelling-style proposal if and only if taxes fall on the consumer surplus of the actual consumers of the product. If a marginal cost pricing scheme passes this "Ruggles test," then the general equilibrium concerns are allayed. But otherwise, policymakers would (implicitly) have to revert to an assumption of equal marginal utility of income across consumers and a willingness to choose higher social welfare even if it involves some redistribution to justify a policy of marginal cost pricing.

The general equilibrium critiques of Lerner (1944), Coase (1946), and Ruggles (1949b) seem to have ended discussion (at least in the United States) of employing marginal cost pricing throughout the entire economy. But this still left the “public utilities,” the specific industries in which the likelihood of natural monopoly and other market-failure concerns had prompted government ownership or regulation. Hotelling had specifically based his 1938 paper on the similarity between the problems of taxation and those of railway rate making; he also mentions electricity and water; and all applied examples at the end of Hotelling’s article concern bridges and railroads.

Vickrey’s Take

William Vickrey (1948) set out to revive the marginal cost pricing proposal, at least for public utilities. In essence, Vickrey argued that the critiques of marginal cost pricing actually point up the general difficulties and opportunities inherent in any decreasing-average-cost industry.

For example, Vickrey (1948) acknowledged that Coase’s (1946) argument convincingly supports multipart pricing when all costs can be attributed to individual users. However, Vickrey argues that common costs, where it is very difficult to attribute costs to users, are the most important case, and Coase’s proposal for multipart pricing in his radial market scenario sidesteps the difficulty of apportioning common costs. In many examples, like the case of the Tennessee Valley Authority, it is possible to estimate future marginal costs conditional on certain facilities being built. On the other hand, estimating future average cost requires difficult cost allocation between flood control, navigation, and electricity generation. Vickrey (1948) argues that “in a decreasing-cost industry, ‘marginal cost’ is a definite concept, though it may be difficult to measure, while ‘average cost’ for a specific type or date of output may be completely arbitrary, though accountants may be able to compute it with great accuracy in accordance with their more or less arbitrary rules” (p. 232).

As for the investment test critique, Vickrey (1948) agreed this was a significant problem but argued that it is always a problem for *any* decreasing-average-cost industry regardless of the pricing system. Multipart pricing often requires the same problematic levels of information as marginal cost pricing does; in contrast to Coase’s radial system, Vickrey points out the complexities of apportioning costs that arise in a circuit delivery service. Vickrey writes: “[I]t is necessary to distinguish carefully between multipart schedules designed to extract a larger fraction of value of the service from the consumer and multipart schedules designed to reflect more accurately the marginal cost of a service having several parameters.” Likewise, “it should not be thought that marginal-cost pricing would necessarily be uniform. . . . The issue is not one of relative complexity of rate schedules, but of the purpose that these complexities are designed to serve” (p. 220). Vickrey points out that requiring self-liquidation to avoid mistaken investment introduces a “substantial bias” against undertaking projects.

Vickrey's most ambitious proposal to implement his ideas was his 1952 proposal for a restructuring of the New York City subway fare structure (Vickrey 1952, 1955). He discussed marginal cost pricing, which implied low or zero fares in the direction against the rush hour, low fares for off-peak and short-haul traffic in the outer boroughs, and high prices for peak trips on the most congested routes. The total revenue would still not cover total costs, so general government revenue would need to make up the difference. Vickrey sought to justify this use of general government revenues based on both the high consumer surplus for users of the service and general benefits to the city from expanded commerce, lower congestion, and environmental considerations.

Aftermath

The marginal cost controversy was never fully settled. Both Vickrey (1970 [1994]) and Coase (1970) were still working on it decades later. In practice, the answer to the controversy seems to be a theoretical admission that marginal cost pricing would be socially efficient in certain industries with declining average costs and low marginal costs, coupled with a pragmatic argument that subsidizing fixed costs in these industries is politically difficult and so regulatory policy for declining-cost public utilities will often need to set prices above marginal cost.

Reflecting the theoretical admission, marginal cost remained the baseline for efficient pricing in textbook discussions. For example, in the 1988 edition of Alfred Kahn's prominent book on *The Economics of Regulation*, Chapter 3 is devoted to marginal cost pricing and begins with strong endorsement of the concept: "The central policy prescription of microeconomics is the equation of price and marginal cost. If economic theory is to have any relevance to public utility pricing, that is the point at which the inquiry must begin" (p. 65).

However, the thrust of pricing policy toward the regulated industries—like electricity, natural gas, telephone, airlines, railroads—in the third quarter of the twentieth century did not involve much in the way of subsidy from general government revenue. Thus the emphasis was on optimal pricing, subject to the self-liquidation constraint that each firm must cover its own total costs. Coase (1970) noted that even in post-World War II Britain, with its many nationalized industries, the government did not implement marginal cost pricing with attendant subsidies. Duffy (2004) summarized the dominant approach:

Modern regulatory policy generally accepts that a declining average cost industry—that is, a so-called "natural monopoly"—will not have its fixed costs subsidized from general government revenues and that therefore the industry must be allowed to price above marginal cost so that it can cover its fixed costs. The rejection of the Hotelling thesis is so complete that reputable economics encompasses the very opposite of Hotelling's view—that, generally, prices which deviate in a systematic manner from marginal costs will be required

for an optimal allocation of resources, even in the absence of externalities.” Indeed, in the parlance of public utility regulation, the very phrase “marginal cost pricing” now refers not to Hotelling’s proposed marginal cost pricing and subsidy scheme, but rather to a pricing system akin to the “multi-part” pricing system that Coase advocated as the more efficient alternative to Hotelling’s proposal. In short, modern public utility theorists generally do not recommend using pervasive public subsidies to chase the Holy Grail of global marginal cost pricing.

Of course, one result of the self-liquidation constraint that utilities must cover their own costs was that pricing had to deviate from marginal cost. This in turn raised questions about the best way to cover fixed costs, whether through some form of average cost pricing or another approach. Baumol and Bradford (1970) applied principles going back to Ramsey (1927) that for greatest efficiency, prices should deviate from marginal cost in inverse proportion to demand elasticity. Ramsey pricing was one solution to the common-cost allocation problem that Coase had struggled with, but Ramsey prices are value-based—that is, they are based on demand for different products—and their use can imply considerable redistribution of income. They are, however, subject to a profit or break-even constraint, which limits the conversion of consumer surplus to producer surplus (Frischmann 2012, p. 16).

Another result was that policymakers tended to deal with externalities and social goals on an industry-by-industry basis. This meant that regulators had to decide how to allocate common costs; for example, telephone regulators had to allocate capital costs when setting long distance and local rates. Sometimes such pricing policies involved significant cross-subsidies between different services. In the telephone case, long distance subsidized local service for many years in order to promote widespread adoption of the telephone. In a competitive marketplace, an overpriced service would have been subject to competitive entry, so cross-subsidies often had to be accompanied by entry restrictions (Faulhaber 1975).

Interestingly, parallel developments in infrastructure outside the traditional regulated industries sometimes did involve something closer to Hotelling’s (1938) approach, though generally without the “marginal cost pricing” nomenclature. In the United States, the most important instance was the (mostly) toll-free Interstate Highway System. In general, the marginal cost of an additional vehicle to the highway system is near-zero, with marginal costs associated with degradation being related to the number of miles driven and gasoline consumed; thus, highways were funded primarily through taxes on gasoline with some contribution from other sources of government revenue (Button 2010). Begun in 1956, the government created wide, fast, and relatively safe highways connecting communities across the nation. This critical infrastructure investment contributed to the growth of the economy by interconnecting markets, lowering the cost of transporting goods and people, and improving connectivity between communities close and distant.

Technological Complementarity, Productive Users, and Spillovers

Hotelling (1938), Coase (1946), and the other participants in the marginal cost controversy implicitly assumed that users of infrastructure were passive consumers operating in an unchanging, complete market without externalities. One exception arises when Hotelling (1938) and Vickrey (1948) mention the Tennessee Valley Authority. Given the large-scale positive externalities that Tennessee Valley electrification and flood control would generate, Hotelling argued that it would be better to sell the electricity at its marginal cost and make up the difference with revenues derived from other parts of the country.

Yet the Tennessee Valley Authority example is hardly exceptional. Many infrastructures generate positive externalities. Modern economics recognizes that infrastructure resources are nonrival or partially nonrival inputs into a wide variety of private, public, and social goods. Consumers of such infrastructures are not passive; instead, their resulting productive activities generate the spillovers (Frischmann 2012). The potential social gains here are substantial. The consumer surplus from introducing a new good, which Romer (1994) suggests should be named the “Dupuit triangle,” is much larger than the deadweight loss triangles caused by slight departures from optimal pricing for existing goods. Similarly, Lipsey, Carlaw, and Bekar (2005) emphasized that the majority of spillovers caused by general purpose technologies are not marginal positive externalities, but instead involve what they term “technological complementarities.”

The issues raised in the marginal cost controversy remain relevant but become more complicated where the assumption of passive consumers operating in an unchanging, complete market is relaxed. For example, marginal cost pricing issues are prominent in the modern arguments over government subsidization of fixed costs of certain information and communication technology infrastructures as well as government regulations that involve nondiscrimination rules for the Internet (the so-called “net neutrality” debate) (Hogendorn 2012).

In the last three decades, the Internet has grown to become an essential national infrastructure. It has reshaped commerce and increased entrepreneurship, as well as affected political discourse, the production and consumption of media, social network formation, and community building (Frischmann 2012). Decisions made in coming years regarding radio spectrum allocation, government investment in broadband and wireless infrastructure, and regulation of privately owned Internet infrastructure will have a direct, significant impact on its future.

A modern-day Hotelling might point out that when a general purpose infrastructure technology supports a number of complementary innovations, the concern with deadweight losses associated with pricing above marginal cost becomes even more pressing. In this situation, it is doubtful whether a multipart pricing scheme would reveal demand not only for the infrastructure in a narrow sense, but also for the eventual complements that would come into being as a result of that infrastructure. This modern-day Hotelling would doubtless point out that even though government subsidies of such technology impose costs on the general public by

taxation, it also may confer widespread general welfare benefits as well. Indeed, the spillover effects from the information and communications technology often involve benefits that flow to those who are not using that technology directly themselves.

Naturally, a modern-day Coase would respond to these arguments by raising various issues and concerns: how alternative multipart pricing strategies might work as a way of paying for such investments; the deadweight losses that would be imposed by taxes to pay for any subsidies; the danger that if fixed costs are subsidized, prices will not reflect opportunity costs and will lead to distortions; and of course the risk that a politically elected government and its regulatory agencies may lack the competence to identify and manage such investments. Thus, modern arguments over public policy in industries with declining average costs are in many ways a reprise and updating of the original marginal cost controversy.

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References

- Baumol, William J., and Bradford, David F.** 1970. "Optimal Departures From Marginal Cost Pricing." *American Economic Review* 60(3): 265–83.
- Button, Kenneth.** 2010. *Transport Economics*, 3rd ed. Edward Elgar.
- Clapham, J. H.** 1922. "Of Empty Economic Boxes." *Economic Journal* 32(127): 305–314.
- Coase, Ronald H.** 1946. "The Marginal Cost Controversy." *Economica* 13(51): 169–82.
- Coase, Ronald H.** 1947. "The Marginal Cost Controversy: Some Further Comments." *Economica* 14(54): 150–53.
- Coase, Ronald H.** 1970. "The Theory of Public Utility Pricing and Its Application." *Bell Journal of Economics and Management Science* 1(1): 113–28.
- Dickinson, H. D.** 1933. "Price Formation in a Socialist Community." *Economic Journal* 43(170): 237–50.
- Duffy, John F.** 2004. "The Marginal Cost Controversy in Intellectual Property." *University of Chicago Law Review* 71(1): 37–56.
- Dupuit, Arsène Jules Étienne Juvénal.** 1844. "De la mesure de l'utilité des travaux publics." *Annales des Ponts et Chaussées* Second series, 8 (November). Translated by R. H. Barback as "On the Measurement of the Utility of Public Works," *International Economic Papers*, 1952, vol. 2, pp. 83–110.
- Faulhaber, Gerald R.** 1975. "Cross-Subsidization: Pricing in Public Enterprises." *American Economic Review* 65(5): 966–977.
- Frischmann, Brett M.** 2012. *Infrastructure: The Social Value of Shared Resources*. Oxford University Press.
- Hogendorn, Christiaan.** 2012. "Spillovers and Network Neutrality." Chap. 8 in *Regulation and the Performance of Communication and Information Networks*, edited by Gerald R. Faulhaber, Gary Madden, and Jeffrey Petchey. Edward Elgar.
- Hotelling, Harold.** 1938. "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates." *Econometrica* 6(3): 242–69.
- Kahn, Alfred E.** 1988. *The Economics of Regulation: Principles and Institutions*. MIT Press.
- Kahn, R. F.** 1935. "Some Notes on Ideal Output." *Economic Journal* 45(177): 1–35.
- Lerner, A. P.** 1934. "Economic Theory and Socialist Economy." *Economic Theory and Socialist Economy* 2(1): 51–61.
- Lerner, Abba P.** 1944. *The Economics of Control*. New York: Macmillan.

Lipsey, Richard G., Kenneth I. Carlaw and Clifford T. Bekar. 2005. *Economic Transformations: General Purpose Technologies and Long-term Economic Growth*. Oxford University Press.

Marshall, Alfred. 1890. *Principles of Economics*. Available online at the Archive for the History of Economic Thought: <http://www.marxists.org/reference/subject/economics/marshall/>.

Nordin, J. A. 1947. "The Marginal Cost Controversy: A Reply." *Economica* 14(54): 134–49.

Pegrum, D. F. 1944. "Incremental Cost Pricing: A Comment." *Journal of Land & Public Utility Economics* 20(1): 58–60.

Ramsey, Frank P. 1927. "A Contribution to the Theory of Taxation." *Economic Journal* 37(145): 47–61.

Romer, Paul M. 1994. "New Goods, Old Theory, and the Welfare Costs of Trade Restrictions." *Journal of Development Economics* 43(1): 5–38.

Ruggles, Nancy. 1949a. "The Welfare Basis of the Marginal Cost Pricing Principle." *Review of Economic Studies* 17(1): 29–46.

Ruggles, Nancy. 1949b. "Recent Developments

in the Theory of Marginal Cost Pricing." *Review of Economic Studies* 17(2): 107–126.

Vickrey, William. 1948. "Some Objections to Marginal-Cost Pricing." *Journal of Political Economy* 56(3): 218–38.

Vickrey, William S. 1952. "The Revision of the Rapid Transit Fare Structure of the City of New York." Technical Monograph no. 3, Finance Project, Mayor's Committee for Management Survey of the City of New York.

Vickrey, William S. 1955. "A Proposal for Revising New York's Subway Fare Structure." *Journal of the Operations Research Society of America* 3(1): 38–68.

Vickrey, William. 1970 [1994]. "Airline Overbooking: Some Further Solutions." Chap. 13 in *Public Economics: Selected Papers by William Vickrey*, edited by Richard Arnott, Kenneth Arrow, Anthony Atkinson, and Jaques Drèze. Cambridge University Press.

Wilson, T. 1945. "Price and Outlay Policy of State Enterprise." *Economic Journal* 55(220): 454–61.

