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# Minimum Standards for Maximum Pricing Constraints

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# Minimum Standards for Maximum Pricing Constraints

*February 28, 2024*

By MARK A. JAMISON <sup>†</sup>

*Government regulators often establish maximum prices for regulated services. This paper explains the proper economic principles for establishing such constraints. The principles imply a range – an upper limit and a lower limit – that constrain the regulator’s discretion. Principles emerging from common law and from economic research align, indicating that, at a minimum, suppliers should have the opportunity to recover the costs created by production and by regulations, as well as costs previously incurred that the regulation makes unrecoverable from the marketplace. Costs created by the regulation include forward-looking production costs for the service in question and for other impacted services, and changes in revenue from other services. Stand-alone costs, incremental costs, and customer willingness to pay serve as bounds in the case where customer options are restricted to subsets of services provided by the firm in question. When customers can seek service from providers that supply services not offered by the regulated firm, and that exhibit economies of joint production, the upper bound on regulated prices is lower than stand-alone costs and the bound is higher than incremental costs. Cases discussed include railroads, utilities, broadband, and housing.*

Keywords: prices, cross-subsidy, regulation, competition

JEL codes: K23, L51, L86, L92

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## 1. Introduction

Governments impose maximum prices on businesses in numerous situations. Some local governments in the U.S. impose rent controls, ostensibly to facilitate affordability for apartments and other forms of rental housing (Glaeser, 2003). Germany capped electricity prices for households and industry in the wake of Russia's invasion of Ukraine (Reuters, 2022). The U.S. Inflation Reduction Act of 2022<sup>1</sup> includes provisions for Medicare to control prescription drug prices. India imposed maximum prices on Uber (Economic Research Centre 2022). The U.S. government imposed maximum prices on certain telecommunications services as part of the process towards deregulation (Kahn, 2004).

The frequent use of such controls implies that they are politically popular even though their effects on consumers are often negative. Many governments around the world impose price limits on infrastructure services, such as utilities and roads. The price controls appeal to voters, but are often inadequate for financing the services, resulting in shortages and low-quality products (Klein and Roger, 1994). This happens even if the infrastructure services are provided by a government entity because it is often politically easy to delay taxpayer-funded investments (Spiller and Savedoff, 1999). Because of this tendency for governments to impose excessive controls, it has frequently been the case in the U.S. that deregulation has served customers better than regulation (Crandall and Ellig, 1997).

Counterproductive price controls can be particularly problematic in industries that are important for social and economic well-being. Governments often address these situations by creating designations, such as public utility, that impose special obligations on the businesses involved, such as an obligation to supply all reasonable requests for services at reasonable prices (Bonbright, 1966).<sup>2</sup> To avoid the situations studied by Klein and Roger (1994), governments also provide these businesses with special benefits, such as being the exclusive service provider in particular areas and

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<sup>1</sup> H.R. 812 - 118th Congress (2023-2024): Inflation Reduction Act of 2023, H.R. 812, 118th Cong. (2023), <https://www.govinfo.gov/app/details/BILLS-118hr812ih>.

<sup>2</sup> I defer the definition of "reasonable" to later in this paper.

establish prices that allow the utility an opportunity to recover its prudently incurred costs (Bonbright, 1966).

Another such business category is that of common carrier. A common carrier is a person or a business that offers to the general public a service transporting persons, products, or other items of value for announced fees (Jamison and Hauge, 2014). Typical examples of common carriers include railroads, airlines, taxis, and telephone providers. In some instances a business providing common carrier services might also be a private carrier, i.e., it provides services under contract. Using contracts rather than public offerings permits private carriers and their customers to customize their agreements.

A current carrier situation in the U.S. is that of railroads. Under the ICC Termination Act of 1995,<sup>3</sup> railroads must hold themselves out as common carriers, but may also engage in private carriage by contracting with individual shippers. Private carrier contacts are unregulated by the industry regulator, the Surface Transportation Board (STB). Common carriage can be brought about in either of two ways: One way is that a railroad provides a tariff from which the public may purchase. Shippers may challenge the tariff terms, rates, and conditions with the STB. The other way is that a shipper may make a request for service from the railroad. If the request is reasonable, then the railroad has an obligation to respond with reasonable rates, terms, and conditions. The STB has authority to intervene and resolve conflicts in situations where a shipper and a carrier disagree on whether a request is reasonable, or on whether the rates, terms, and conditions offered are reasonable.

In the case of telecommunications services, the Federal Communications Commission (FCC) traditionally defined only basic telecommunications services as common carrier, as in its Computer II Inquiry,<sup>4</sup> where the FCC defined basic service as the transmission of information without “computer processing

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<sup>3</sup> Interstate Commerce Commission Termination Act of 1995, Pub. L. No. 104–88, 109 Stat. 803, codified in relevant part at 49 U.S.C. §10706. Also important was the Staggers Rail Act of 1980, Pub. L. 96–448, S. 1946, 94 Stat. 1895, enacted October 14, 1980 (hereafter IICTA).

<sup>4</sup> Notice of Inquiry and Proposed Rulemaking, 61 FCC 2d 103 Supplemental Notice of Inquiry and Enlargement of Proposed Rulemaking, 64 FCC 2d 771; Tentative Decision and Further Notice of Inquiry and Rulemaking, 72 FCC 2d 358; and 77 F.C.C.2d 384 [hereinafter CI-II Final Decision].

applications that act[ed] on the format, content, code, protocol, or similar aspects of the subscriber’s transmitted information, or provide[d] the subscriber additional, different, or restructured information, or involve[d] subscriber interaction with stored information.”<sup>5</sup> All other services were considered enhanced or information services.

There is current controversy over whether broadband providers in the U.S. should be considered common carriers in the same way that telephone service providers were under Title II of the Communications Act of 1934 and subsequent amendments.<sup>6</sup> Part of the issue is that Title II provides utility-style regulation because it was written when telephone companies were legal monopolies. Regulating broadband providers under Title II can be uneconomically distortive with broadband markets being open to competition. The common carrier designation also implies that broadband should be basic, i.e., including no features that enhance the customers’ communications experiences. This is counterproductive as many customers benefit from customized features (Jamison, 2019).

There are efforts by the National Telecommunications and Information Administration (NTIA) and some states to effectively regulate certain broadband prices by placing price controls as conditions for broadband providers receiving funds under the Broadband Equity, Access, and Deployment (BEAD) program, a prominent feature of the Infrastructure Investment and Jobs Act<sup>7</sup> (NTIA, 2023). The NTIA (2023) suggests that price controls targeted for low-income households and others for the middle class would ensure affordability. Some states appear to be amenable to this thinking.

Regulatory imposition of maximum prices is controversial because it affects the value producers create in the economy and who receives what portions of the created value. A price restriction that is below a level that is mutually acceptable to buyers and sellers can lead to shortages and suboptimal quality. It might also create

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<sup>5</sup> CI-II Final Decision at 5 and 12.

<sup>6</sup> Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (1996) (hereafter, 1996 Act).

<sup>7</sup> Infrastructure Investment and Jobs Act, Pub. L. No. 117-58 (2021), <https://www.govinfo.gov/app/details/PLAW-117publ58>.

inefficiencies, discourage buyers from migrating to alternative sources of supply such as changing from old technologies to new ones, discourage sellers from developing new technologies, and hinder competition (Crandall and Ellig, 1997; Kahn, 1988).

The purpose of this paper is to present the proper economic principles for establishing regulated maximum prices. The key principle is that of commercial viability, although the means for achieving this may vary from situation to situation. In the cases of railroads and broadband, the providers serve both unregulated and regulated markets, and both types of markets are open to competition. In this context the regulated prices must be commercially viable as a subset of what the service provider supplies, lest the degraded service scenario described above becomes reality. This contrasts with public utilities, which largely serve protected monopoly markets and can thus engage in cross subsidies between types of customers, subject to the subsidizing customers' willingness to pay.

Also in railroad markets, shippers can engage in gamesmanship by strategically choosing whether to buy under a private contract or under common carrier. In addition, shippers can contract for different capacities that affect the probabilities of their cargo being delivered within a particular timeframe. Shippers may also include capacity demand in their request under common carrier, in which case the STB may determine how much of the railroad's capacity to devote to particular shippers. Given capacity constraints that any railroad has in the short run, this regulatory grant of capacity to common carrier shippers could interfere with the railroad's existing commitments to other shippers. Also, unless the regulator is fully knowledgeable about the future impacts of capacity commitments, future shippers may be underserved.

Broadband price restrictions as part of BEAD involve a quid pro quo in which a provider agrees, in exchange for a subsidy, to deliver services in an area where they are (presumably) not commercially viable absent the subsidy. If the requirements for receiving the funding are well understood in advance, the government makes credible commitments, and the requirements are modest in scope and time, then the quid pro quo can result in adequate service. But there are potential problems. Price

restrictions decrease commercial viability, creating needs for even larger subsidies. And there would likely be less competition for the subsidies. Restrictions that are in place for very long limit broadband service providers' abilities to adapt to changing economics, technologies, markets, and customer desires. This increases risk, which lowers competition and investment. It also limits service performance for customers, giving them less value.

The rest of this paper proceeds as follows. The next section summarizes historical experiences with price controls. Section III describes the economic principles for maximum pricing constraints, including those that evolved with utilities and common carriage and those that emerged from economic research. Section IV applies these principles to current situations. The last section is the conclusion.

## 2. Historical Experiences

**Utility Regulation in the United States.** Utility enterprises are generally regulated monopolies, with the monopoly status inferred by a certificate of convenience and necessity. This utility status currently applies to electricity, natural gas, and water utilities in the U.S. It historically applied to telephony, but that service is disappearing. A typical utility would have different prices for residential customers, small business customers, and large business and industrial customers. Some utilities will also have special prices for customers that are of strategic importance, such as companies that the regulator believes are important for economic development.

The restriction on competition makes it feasible for the government to impose obligations on the utility that the enterprise could not fulfill without internal cross subsidies. Such restrictions might include obligations to serve everyone in the utility's service area, limits on price and service discrimination, and limits on price levels. An internal cross subsidy is a situation where a utility uses revenue from one set of customers to make serving another set of customers financially viable.<sup>8</sup> Such a subsidy might

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<sup>8</sup> More specifically, a cross-subsidy exists if the provision of each service or group of services by the firm is not Pareto superior to no provision, i.e., some consumer or group of consumers finds the pricing and service provision to be less preferable than (1) only some of the services being are provided by the enterprise



be needed if, for example, a utility is obligated to serve customers that live in remote rural areas, whose costs to serve are high, at the same prices that the utility charges urban customers, whose costs to serve are lower. As long as the sum of the revenue from all customers covers the sum of the costs, as defined in Section III, the obligation is financially viable.

For legal and economic reasons, the price limits must allow the utilities an opportunity to recover costs prudently incurred for providing the utility service and to receive a fair return on investment (Bonbright, 1961; Jamison, 2011). Some governments outside the U.S. are not constrained by such laws. These governments sometimes behave opportunistically, with the result that investments are inadequate to ensure service (Klein and Roger, 1994; Bergara, Henisz, and Spiller, 1998). The economic principles for sustainability of price controls apply to utility prices in aggregate and sometimes on a more limited basis to individual prices or services.

### **2.1. Telecommunications in the United States after 1996.**

The Telecommunications Act of 1996<sup>9</sup> altered the course of the telecommunications industry by making it the policy of the country for all markets to be open to competition. When enacted, the 1996 Act viewed the industry as a network of interconnected and sometimes competing networks, with some telephony providers having the advantage of incumbency. At that time, incumbent telephone companies were regulated by the FCC and by state utility regulators as public utilities.

Congress rightly saw that entry into these formerly monopoly markets would be difficult: Almost all areas of the country were already served by the incumbents' networks, so new entrants that built facilities would generally be duplicating the incumbents' networks. To address this challenge, the law required incumbents to allow rivals to resell the incumbents' services and to lease parts of their networks to the rivals at prices "based on the cost ... of providing the interconnection or network element."<sup>10</sup> Both incumbents and entrants were also obligated to interconnect their networks for the exchange of telephone calls and to engage in reciprocal

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(Faulhaber, 1975) or (2) what could be obtained if another enterprise that serves markets unserved by the firm in question, added this consumer or group of consumers to its market mix (Jamison, 1999).

<sup>9</sup> Telecommunications Act of 1996, Public Law No. 104-104, 110 Stat. 56 (codified as amended in scattered sections of 15, 18, and 47 U.S.C.) [hereinafter 1996 Act].

<sup>10</sup> 1996 Act Sec. 252 (d) (1) (A) (i).

compensation, i.e., pay each other for the exchange of calls.

The FCC decided its standard for cost would be Total Long Run Incremental Cost (TELRIC), which it defined as the sum of the forward looking, minimized costs, including a return on capital, for all inputs required to supply a leased network element (Economides, 1999; Kahn, 2004). The costs were forward looking in the sense that they were estimates of what providers would expend to build their networks at that time, not what they had spent when the networks were built.<sup>11</sup> The costs were minimized in the sense that the formulas assumed that the network provider was technically efficient, i.e., minimized its cash outflow while providing the required services at the required quality. TELRIC was not compensatory of the actual costs incurred by the incumbents because the minimization standard omitted the need to recover capital costs early in an asset's life. This early recovery is necessary if estimating actual costs because improving technologies lower costs over time. Furthermore, the method's assumed cost of capital failed to compensate incumbents for their being required to protect rivals from technology risks (Kahn, 2004, pp. 29-30). There was also the risk that regulators would assume production efficiencies that were not achievable in practice. As a result, the TELRIC-based prices led the rivals to underinvest in their own networks and caused a form of undersupply of leasable network components and features. The consequence was less competition from new entrants than would have occurred with higher prices (Ingraham, Singer, and Crandall, 2004; Hauge, Jamison, and Gentry, 2008; Jamison, 2004).

## **2.2. Rail Regulation in the United States.**

Rail regulation in the United States was so poorly done prior to the Staggers Act of 1980 that some railroads went bankrupt, shippers were underserved, and the industry was in general decline. In 1976, 11 of the largest railroads were receiving negative returns on investment, three were in bankruptcy reorganization, and the 36 largest railroads had a maintenance shortfall of about \$4 billion, or nearly 15% of their net investment (General Accounting Office, 1990; Interstate Commerce

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<sup>11</sup> It could be argued that the law prohibited the FCC from considering what the companies had spent as the 1996 Act said that cost had to be "determined without reference to a rate-of-return or other rate-based proceeding," (1996 Act Sec. 252 (d) (1) (A) (i)) which at the time would have been understood to mean costs as measured in the accounting records as those were the cost measurements used by the states and the FCC for determining regulated prices.

Commission, 1977). Rail regulation limited railroad managements' abilities to address these financial problems until the Staggers Act largely deregulated the industry, with some residual rate regulation for shippers that had no effective alternatives. The deregulation brought service up to world standards, improved the financial health of the railroads, and improved the welfare of shippers. All shippers experienced this improvement, including those that had no effective alternatives to a single railroad. Such shippers can challenge prices under the ICCTA. A successful challenge must show that the prices in question exceed 180 percent of variable costs, that there is no effective competition to the railroad in question, and that the prices are unreasonable. These last two criteria are sufficiently vague that regulators have considerable discretion despite the very specific 180-percent standard (General Accounting Office, 1990; Grimm & Winston, 2000).

### **2.3. Rent Controls.**

Rent control has been a source of debate over the years. Proponents argue that it assists the poor. Opponents hold that it leads to deterioration of housing, abandonment of possible rental properties, underinvestment in new rental housing, and misallocation of resources (Moon Stotsky, 1993). Rent control is generally done by cities and methods vary. New York City, for example, has used various forms of rent control over several decades. A common feature is limits on whether and how much rent can increase. Moon and Stotsky (1993) study the market and find that the price limits result in lower quality housing, implying that proper economic standards were not followed. Glaeser (2003) also studies New York and finds shortages for some individuals and over consumption by others.<sup>12</sup>

## **3. Pricing Principles**

Case law and statutes often hold that regulated prices must be reasonable. This section explains that to be considered reasonable under accepted legal practices and economic principles, a pricing constraint must ensure adequate supply at the proper

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<sup>12</sup> New York's rent control laws are currently under challenge before the United States Supreme Court in *74 Pinehurst LLC v. New York*. Another real estate takings case before the Court is *Sheetz v. County of El Dorado*.

quality. The standards that evolved in the common law in Europe and in the U.S. align with the economic principles developed for both utility pricing and for setting maximum price constraints for partially deregulated industries. This section first reviews the legal principles that emerged under common law and then examines the economic literature. It concludes with applications to railroads and to broadband in their current contexts.

### **3.1. Common Law Development: Common Carrier, Utilities, and Price Controls**

Classifying a firm's service as common carriage generally imposes explicit obligations on the firm. There is a common law foundation for these obligations, but today they are typically spelled out in legislation and sometimes detailed in regulatory rules (Payton, 1981; Cherry, 1999; Hauge & Jamison, 2014). These obligations would typically include an obligation to serve at a reasonable price without undue discrimination and to exercise extraordinary care in handling customers' property.

Common carrier obligations emerged in common law from the special roles that the services of firms carrying goods on behalf of others played in the economy, beginning late in the Middle Ages, and continuing into the Renaissance. The services were generally considered essential for shippers' participation in the economy and that customers were particularly vulnerable if they were refused service or discriminated against, or if the carrier did not exercise care in handling the customers' property. The primary issues in the courts during this era were fulfillment of services and undue price discrimination. Overall price levels do not appear to have been in dispute. Customers were considered vulnerable if they had no alternative sources of supply. That said, there is little or no evidence in the courts' decisions that they gave thought to whether a firm was a monopoly or virtual monopoly before imposing special obligations (Payton, 1981).

The importance of monopoly in common carriage emerged explicitly as U.S. courts and legislative bodies grappled with the challenges of market entry and pricing (Trebing, 2001). It became clear that governments could not and should not impose obligations that a firm could not commercially fulfill (Phillips, 1993). This consideration led governments to protect such carriers from competition by making

them franchised monopolies, and to apply the utility rate setting system, allowing them cost recovery and reasonable profits (Phillips, 1993; Janson & Yoo, 2013).<sup>13</sup> Absent an external subsidy, protection from competition is necessary because some obligations impose financial losses on a carrier. The monopoly status enables internal cross-subsidization between profitable and loss-making services. Absent a protected market from which a carrier can extract a subsidy, the firm would be unable to fulfill the unprofitable obligation. As a result, where competition is allowed, such as in trucking, railroads, and broadband, the government should either refrain from imposing loss-making obligations or provide a subsidy (Kahn, 1998; Payton, 1981; Jamison, 2011).

Courts have also noted the importance of compensatory prices for regulatory-imposed service changes and for individual services. In *Northern Pacific Railway Co v North Dakota*,<sup>14</sup> the Court said that if the regulated railroad devoted property to providing service to the public on certain terms, the government is not allowed to require that the property “be devoted to other public purposes, or to the same use on other terms,” or impose restrictions “that are not reasonably concerned with the proper conduct” of the railroad’s business. The Court went on to say that compensation is required even if the railroad is receiving an adequate return overall.<sup>15</sup>

This need for subsidization between services sometimes emerges when governments include affordability as a significant factor for determining reasonableness of prices. For example, the NTIA’s BEAD guidelines (NTIA, 2023) hold that at least some prices charged by funded broadband providers should be affordable for the middle class, although the NTIA does not define “affordable.” This policy has several problems (Jamison, 2024), including inadequate service if the BEAD subsidy is insufficient. Similarly, if the STB were to consider shipper affordability in determining reasonableness of rail prices, the consideration should affect prices only to the extent that prices remain profitable for the railroad, as the next subsection explains.

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<sup>13</sup> Many common carriers, such as railroads and trucks, are not provided protected markets.

<sup>14</sup> 236 U S 585 (1915).

<sup>15</sup> *Id.* at 595-96.

Affordability is also used as an argument in favor of government regulation housing prices and charges mobile phone platforms, such as Apple and Android, impose on app developers. In the case of housing prices, basing prices on affordability consideration has led to declines actual affordability, fueled gentrification, and harmed surrounding neighborhoods (Diamond, 2018). Regarding app stores, the public policy debates include assertions that Apple and Alphabet charge prices that are unaffordable for some app developers. For example, some elected officials in the U.S. argue the companies have monopoly power and price in ways that limit the number of app developers (Govtrack, 2021). Others argue for price regulation (MacCarthy, 2024). Missing from their arguments is any consideration of the economic principles that should underly such price controls.

### **3.2. Economic Principles**

The principles emerging from economic analysis and from common law are effectively the same, namely that absent a subsidy, government-imposed maximum prices should fully compensate the regulated business for its costs, including the effects on other parts of the business and a fair return, and including effects of regulatory changes. The articulation of the economic principles began in contexts such as emerging competition against the AT&T monopoly in the late 1970s, where rivals such as MCI wanted to provide a subset of the services that AT&T provided. This paper calls this the restricted case because of the limiting assumption that economies of joint production are only found within the firm in question. Later analyses considered situations, called unrestricted cases, where other firms, which supply other mixes products and markets, can supply some of the regulated firm's customers and experience economies of joint production between that supply and the alternative firm's existing products and markets. The explanation of economic principles begins with the restricted case analyzed by Baumol (1979).

#### **3.2.1. Restricted Case**

Baumol (1979) was among the first to explain the basic economic principles for maximum price constraints for partially deregulated firms, using a framework developed by Faulhaber (1975). Faulhaber's framework examined conditions under which a supplier's prices should be considered subsidy free, i.e., prices that "do no

more than insure that the production and sale of each commodity makes all consumers at least as well off as they would otherwise be.” He limited his analysis to situations where the customers’ alternatives were restricted to either not buying anything or buying from an alternative supplier that served only a subset of the initial supplier’s markets. His stylized example was four neighborhoods sharing a well for water, a pumping station, and pipes, with some pipes being dedicated to specific neighborhoods.<sup>16</sup> Consumers’ choices were limited to systems specialized in serving no more than one, two, three, or all four of the neighborhoods. A system that might serve some of those neighborhoods, plus other neighborhoods – an unrestricted case – was not considered.

Faulhaber argued that a set of prices should be considered subsidy free only if it induced each neighborhood, and each group of neighborhoods, to cooperate in the least-cost arrangement for supplying their needs. This implies that if a set of prices made a neighborhood (or group of neighborhoods) pay more than it would cost for the neighborhood (or group of neighborhoods) to go it alone, then the prices were not subsidy free in the sense that these subsidizing neighborhoods would be better off without the subsidized neighborhoods. More formally, per Faulhaber, a set of prices is subsidy free if and only if the prices result in: (1) each neighborhood paying the difference in cost between a system serving all four neighborhoods and a system built just for the other three neighborhoods; (2) any two neighborhoods paying the difference in cost between a system serving all four neighborhoods and a system built just for the other two neighborhoods; (3) any three neighborhoods paying the difference in cost between a system serving all four neighborhoods and a system built just for the other one neighborhood; and (4) all four neighborhoods paying no more than the cost of the four-neighborhood system. This standard for subsidy-free prices is intuitive, but complicated to apply because of the need to consider all possible arrangements of the neighborhoods in question.

Baumol extended this analysis, arguing that maximum price constraints should not extend outside the range of subsidy-free prices, i.e., a maximum price constraint should never result in revenues below the incremental cost nor above the standalone

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<sup>16</sup> Hereafter, this is called the “Faulhaber scenario.”

cost of supplying the regulated products. The standalone cost is “the cost of a single purpose facility or system built to serve the user requirements of the particular group most affected by the upper price limit” (Trebing, 1967, as cited in Faulhaber, 1975). The incremental cost is “the additional cost to the firm’s total cost by the specified change in of the output of each of the firm’s products” (Baumol, 1979).

To illustrate, consider a situation different from the Faulhaber scenario in which a water system serves only two neighborhoods (hereafter, the “two-neighborhood scenario”). The total cost of supplying both neighborhoods is \$400 and of serving just one is \$300. The incremental cost of serving one is \$400 minus \$300 or \$100. Under Baumol’s criteria, a government-imposed maximum price should be no higher than \$300 (the standalone cost) and no lower than \$100 (the incremental cost). The basic logic is that prices that produce revenue less than incremental cost are not financially feasible absent a subsidy because, in a market open to competition, the other customers would be unwilling to finance the below-cost pricing.

### 3.2.2. Unrestricted Case

The restricted case establishes boundaries in situations where the products the firm in question offers have economies of scope only between each other and not with products produced by any other firm.<sup>17</sup> There may be situations where this assumption does not hold. For example, a trucking firm might have economies of joint production if it added servicing a railroad shipper to existing services. In these situations, standalone cost is too high of an upper bound and incremental cost is too low of a lower bound (Jamison, 1999).

To illustrate, consider the following situation, called the four-neighborhood scenario, which extends the two-neighborhood scenario. Neighborhoods 1, 2, 3, and 4 are deliberating sharing a water system. The neighborhoods are arranged in a rectangle, where neighborhoods 1 and 2 are adjacent, neighborhoods 3 and 4 are adjacent, and the sides of the rectangle connecting 1 and 2 or connecting 3 and 4 are the shorter sides. Their cost options are as follows:

$$C(1,2,3,4) = \$900$$

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<sup>17</sup> More technically, the economies in question are cost subadditivity. Economies of scope in economics refers specifically to the cost savings that occur from jointly producing two or more products. Subadditivity is a more technical and general economics term that refers to the situation where the cost of jointly producing particular quantities of a set of products is less than the cost of any partition of the production across two or more firms.



$$C(1,2,3) = C(1,2,4) = C(1,3,4) = C(2,3,4) = \$650$$

$$C(1,2) = C(3,4) = \$400$$

$$C(1,3) = C(1,4) = C(2,3) = C(2,4) = \$500$$

$$C(1) = C(2) = C(3) = C(4) = \$300$$

where  $C(arg)$  is the cost function for the neighborhoods in question sharing a single system.

The least cost option is for neighborhoods 1 and 2 to share a system and neighborhoods 3 and 4 to share a system. This arrangement costs \$800. Within this arrangement, the incremental cost for each neighborhood in its sharing agreement is  $\$400 - \$300 = \$100$ , as in the two-neighborhood scenario. If this were a restricted case, a regulator could set a maximum price for one neighborhood to be \$100 and the partner neighborhood, which would pay \$300, would be no worse off than going it alone. This would be subsidy-free as defined by Faulhaber (1975). But in the four-neighborhood scenario, each neighborhood has an alternative that is better than a \$300 standalone arrangement.

Assume the regulator favors neighborhood 1 and requires that it pay no more than \$100 in its sharing arrangement with neighborhood 2. Such a requirement would break up the neighborhood 1 and 2 sharing arrangement because neighborhood 2 could join neighborhoods 3 and 4 at an incremental cost of  $\$650 - \$400 = \$250$ . Because of this opportunity, the lowest price constraint that the regulator can impose is not \$100, but  $\$400 - \$250 = \$150$ .

The opportunity for neighborhood 2 to join neighborhoods 3 and 4 is relevant even though it is inefficient. It is inefficient because the least cost arrangement is for 1 and 2 to share and for 3 and 4 to share. Even so, the 2-3-4 arrangement places an upper bound on how much neighborhood 2 would be willing to pay while remaining in the sharing arrangement with neighborhood 1. This means that a government imposed maximum price must be at least \$150, not the \$100 that would be calculated using the criteria developed by Baumol (1979) for the restricted case.<sup>18</sup>

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<sup>18</sup> The lower bound for the price(s) constraint is the (set of) minimum unrestricted subsidy-free price(s). The technical economic expression of this price(s) is that which produces revenue equal to  $C(T^*(N, Q_N^*)) -$

The \$150 lower bound on a regulatory price constraint can be found in the manner described in the previous two paragraphs, namely by examining other customers' opportunity costs, or reserve prices, for staying with current arrangement, and subtracting it from the total cost of the current arrangement. Another approach is to examine the total burden that a product or group of customers places on the economy. In the four-neighborhood scenario, this approach would examine the burden neighborhood 1 places on the cost of serving the remaining systems by joining in a sharing arrangement: The total cost of serving just neighborhoods 2, 3 and 4 is \$650. Introducing neighborhood 1 reconfigures the production arrangement and raises the total cost to \$800. The \$150 is the difference between the two total costs, i.e.,  $\$800 - \$650 = \$150$ .

In the unrestricted case, a maximum price restriction for a group of products produced by a firm should be based on difference between the total cost of all the firm's products minus the best alternatives that could be found for the firm's remaining products. In the example, the best alternative for any single neighborhood is \$250 and the total cost of the sharing arrangement is \$400, so the maximum price constraint must be no lower than \$150 and no higher than \$250. These boundaries imply that all products provide some contribution to the firm's shared or overhead costs in the unrestricted case. In the restricted case, any assignment of shared costs is generally considered to be arbitrary.<sup>19</sup>

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$C(T^*(N - X, Q_{N-X}^*))$ , where  $C$  is the cost function,  $N$  is the vector of all products in the economy,  $X$  is the product(s) in question for determining the subsidy-free price(s),  $Q_Y^*$  is the optimal production of products  $Y \in \{N, X, N - X\}$ ,  $T$  is a partitioning of the production of products across firms, and  $T^*$  is one of the cost minimizing partitions of production across firms, i.e.,  $T^* \in \left\{ \hat{T} \mid C(\hat{T}(Y, Q_Y^*)) \leq C(T(Y, Q_Y^*)) \forall T \neq \hat{T} \right\}$  (Jamison, 1999). This definition applies to both the restricted and unrestricted cases. The revenue from minimum subsidy-free price(s) is equal to the extra cost of adding  $X$  to the economy, considering the cost subadditivities that it creates with other products and the cost subadditivities lost by the re-partitioning of production across firms. A set of minimum subsidy-free prices is not necessarily unique.

<sup>19</sup> Shared costs are costs necessary to produce all the products of the firm, but not caused by any proper subset of products. For example, in the four-neighborhood scenario, the cost of serving neighborhoods 1 and 2 is \$400 and the incremental cost of either 1 or of 2 is \$100. The shared costs are  $\$400 - \$100 - \$100 = \$200$ . In the restricted case, determining how much each neighborhood should contribute to covering the \$200 is a matter of social preferences regarding the two neighborhoods, i.e., the least favored neighborhood would be asked to contribute more than the other. In the unrestricted case, each neighborhood must contribute at least \$50 to covering the shared costs, leaving only \$100 to be assigned based on social preferences.

### 3.2.3. Other Considerations

In some situations, regulators setting maximum prices have miscalculated costs by failing to consider all the effects of a regulatory requirement. Baumol (1979) characterizes this as focusing on gross incremental costs and revenues rather than net. The net effect takes into consideration how the provision of the service and the regulatory constraint affect costs and revenues for other aspects of the business.

To illustrate, suppose that a government decided that a broadband provider is required to offer a specific low-price, low-speed option. This low-price option necessarily competes with other options that the broadband provider offers – i.e., customers may choose amongst all options and so each option competes with the others. Decreasing the price of the low-price option results in revenue declines for those other options. These revenue losses are costs of the regulatory requirement, which may be partially offset by cost differences between the low-speed option and the other options if the cost of providing the low-speed option is less than the costs of other options. If the low-speed option is more costly to provide, then the cost difference adds to the cost of the regulatory requirement.

To illustrate, consider the situation of a broadband provider offering two bandwidths for broadband, a 300 megabits-per-second (Mbps) service and a 1 gigabit-per-second (Gbps) service.<sup>20</sup> There are 2,000,000 customers and they are evenly divided into two types. One type, the low-demand type, is willing to pay \$55 per month for the 300 Mbps service and \$60 per month for the 1 Gbps service. The other type, the high-demand customer, is willing to pay \$60 per month for the 300 Mbps service and \$85 per month for the 1 Gbps service. Further assume that the incremental cost to supply the 300 Mbps service is \$47 and is \$71 for the 1 Gbps service, both of which are same for all customers, and there are shared costs of \$17 million. Finally assume that the provider sells the services through its website, so that each customer can choose which bandwidth it wants to buy. To maximize its profits, the provider, if unregulated, would charge \$55 for the 300 Mbps service and \$80 for the 1 Gbps service.<sup>21</sup>

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<sup>20</sup> This example is adapted from Jamison (2024).

<sup>21</sup> To maximize profits, the firm chooses to charge \$55 for the low-speed service, which is the most it can

Now assume that a regulator believes that the \$55 price for the low-speed service is an unreasonable burden on low-demand customers and, noting that the incremental cost is \$47, requires the operator to offer that price. This requirement has implications for the high-speed service price. If the operator tried to charge \$80 for the high-speed service in the presence of a \$47 price for low-speed, the high-demand customers would buy the low-speed service because doing so would provide them with a net consumer surplus of \$8 rather than the \$5 each would receive buying the high-speed service. Therefore, to sell the high-speed service the firm would have to drop its price to \$72, resulting in \$8 million less revenue. The incremental cost to the firm of the regulatory requirement would include this \$8 million loss in revenue.<sup>22</sup> Indeed, because of the substitutability between the high-speed and low-speed service, a price control on the low-speed service makes the enterprise unprofitable.

It might also happen that only cost changes make the net effect different from the gross effect. For example, suppose a rail shipper made a request for common carriage and the railroad found the request unreasonable because it would interfere with the company's ability to serve some private carriage shippers. If the STB were to side with the shipper, the railroad would have to comply with the STB's decision and incur additional costs to keep its commitments to the private carrier customers.

To illustrate, consider a situation where rails connect towns A and B that are 200 miles apart, towns B and C that are 40 miles apart, towns C and D that are 20 miles apart, and towns D and A that are 100 miles apart. These are the only rail

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charge while also ensuring that the low-demand customers buy it. The firm must also ensure that the high-demand customers buy the high-speed service at a price that provides more profit at the margin than letting them buy the low-speed service. The high-demand customers would receive a net consumer surplus of \$5 from buying the low-speed service at \$55, so the provider can charge no more than  $\$85 - \$5 = \$80$  for the high-speed service. This is profitable as the marginal profit from the low-speed service is \$8 and the marginal profit from the high-speed service is \$9 at this price. The firm receives zero economic profit with these prices. A lower price for the high-speed service lowers profits, as does a higher price. At a higher price for the high-speed service, the high-demand consumers buy the low-speed service, which has a lower profit margin, resulting in an overall loss. Choosing to sell only the high-speed service would allow the firm to price it at \$85, but no low-demand customers would buy, also resulting in an overall loss.

<sup>22</sup> The decrease in revenue to the firm would be \$16 million: \$8 million from the decrease in price for the high-speed service and \$8 million from the price decrease for the low-speed service. Economic profits would drop from zero to -\$16 million, which means that the firm would need to receive a subsidy to stay in business. If it fails to receive the subsidy, the firm either goes out of business or, if possible, lowers its quality until costs align with revenue.

connections. Railroad costs for hauling freight are \$1000 per mile per year. Further assume that the railroad in question carries freight for existing shippers from A to C under private carriage. The least costly arrangement is to carry the freight through D as this is half the distance of going through town B. Now assume that additional shippers in D request shipping to A as common carriage and the regulator supports the request. The gross incremental cost would be just the cost of shipping from D to A, or \$100,000. But if shipping from D to A forces some of the private carriage to travel through B, costs are higher. For example, if half of the private shipping must now take the longer route, the costs of the private carriage is increased from \$120,000 to \$180,000, or by \$60,000. This is part of the net effect of the common carrier obligation, which makes the common carrier incremental cost \$160,000, not \$100,000.

There are also intertemporal effects that affect the net incremental cost. Suppose that the regulator in the rail scenario of the previous paragraph considered only the gross effect of the common carrier service, causing the railroad a loss of \$60,000 per year because costs increased by \$60,000, but revenue did not. When it is time to renew the private contract, the railroad would need the contract to cover its \$180,000 incremental cost. If the shippers have a competitive alternative that is more economical, they will drop the railroad's service. Assuming there are fixed costs, such as overhead or other shared costs, that do not change with the loss of the private carriage, the railroad loses this private carriage service's contribution to covering these costs, and that loss is part of the net effect of the common carrier service.<sup>23</sup>

In the case of broadband, the provider might offer enhanced networking services in the future, such as channel slicing and conditioning services made possible with advanced wireless technologies. To encourage customers to upgrade to the newer technology, the provider would want the difference between the prices for the old technology and the newer technology to be no greater than the difference in value

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<sup>23</sup> Fixed costs in this context are costs that do not vary with the quantity produced. These are sometimes called long-run fixed costs. This is different to another concept of fixed costs often used in economics. This other concept relates to how costs can be changed with respect to particular time periods, i.e., in the short run, some costs cannot be varied and are referred to as fixed costs.

to the customers. But the regulator's controls on the low-speed service makes it more costly to achieve this price difference. Such a regulation lowers the profitability of the newer technology and delays its availability.

Going back to the previous broadband example, assume the provider can offer a new technology and that low-demand customers would be willing to pay an additional \$5 to obtain it. If there were no regulation on prices, the operator could charge \$55 for the low-speed service and \$60 for the new technology, which would encourage low-demand customers to adopt it. But with the regulation, the operator can charge no more than  $\$47 + \$5 = \$52$  for the new service. This diminishes the profitability of the new technology, which would slow its introduction.

Another consideration in estimating incremental costs is the effect of the regulation on recovery of costs already incurred. Generally, estimates of production costs to be used for developing price constraints are forward looking, meaning they represent facility costs as expenditures that would be required to replicate or replace the facilities used to provide the services in question (Baumol and Merrill, 1997). This stands in contrast to historical costs, which are the amounts spent in the past for said facilities, less accumulated depreciation.

Forward looking costs are appropriate for price signals that affect ongoing economic decisions by customers and producers. However, if the new regulatory constraint negatively impacts the producer's ability to recover its historical costs, producers will likely see this as an indication of how costs will be treated going forward and invest less. Something like this occurred with telecommunications pricing in the early 1990s (Kahn, 2004). Fortunately, the error was short lived as regulators soon began deregulating prices. If regulators do impose restrictions that restrict historical cost recovery, they should create and implement a separate mechanism for that recovery. This is important as a matter of regulatory takings (Sidak and Spulber, 1998) and to encourage future investment. Producers will suppress future investment if they are concerned that regulators will behave opportunistically and restrict opportunities for cost recovery (Spiller, 2005).

Consider, for example, a situation that might occur in railroads. Currently the STB investigates the reasonableness of rail earnings using historical costs as its cost

measure. If the STB chooses to control common carrier prices at forward looking costs and misestimates those, perhaps because of improper assumptions such as was the case with the FCC, then the loss of opportunity for the railroad to recover historical costs would be a cost of the common carrier obligation and a compensation mechanism should be developed.

This was the situation when state governments in the U.S. restructured some electricity markets. Traditional utilities owned electricity generators, transmission lines to connect the generators to communities, and distribution lines to connect to households, businesses, and other customers. Transmission and distribution are thought to be natural monopolies, but electricity generation can be opened to competition. To accommodate this competition, some states required their electric utilities to sell their generating assets, thinking that if a utility operated generation as part of its utility business, it might discriminate against rivals. In some instances, the selling prices for the assets were less than historical cost, less accumulated depreciation, creating what were called stranded costs. Consistent with the principles of allowing an opportunity for cost recovery, regulators developed competitively neutral mechanisms for recovering these stranded costs (Joskow, 1996).

In summary, except in rare situations such as the restricted case, a regulatory-imposed maximum price should always be greater than the incremental cost for the provider, where the incremental cost includes costs created for the firm's other products, lost revenues from other products, and the loss of efficiency if the regulation distorts markets.

#### **4. Conclusion**

This paper explains the principles for price constraints that regulators might impose on private businesses. The impetus for the paper is the number of situations where governments are seeking to impose maximum prices on firms without following proper economic principles and the underlying logic of legal precedence. This paper shows that principles emerging from common law and from economic research align: Providers should have the opportunity to recover their production

costs, costs created by regulation, and costs previously incurred that are unrecoverable from the marketplace because of the regulations. The costs created by the regulation include the forward-looking production costs created to provide the service in question and to provide other services impacted by the regulation, changes in revenue from other services, and unrecoverable costs resulting from customers of non-regulated products having opportunity costs that are less than their stand-alone costs.



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