The Economic Costs of Spectrum Misallocation:

Evidence from the United States

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Abstract

During the past two decades, U.S. spectrum policy has gradually become more market-oriented, and consumers have reaped significant benefits as a result. Nevertheless, current policy still generates large inefficiencies by preventing reallocation of spectrum to its most highly-valued uses. The consumer costs of current policy likely exceed $77 billion annually. Spectrum allocation accounts for more than two-thirds of the total costs of federal telecommunications regulation to consumers and society. The associated excess burden exceeds the excess burden associated with general taxation. Even if the actual costs of U.S. spectrum allocation policy were only one-tenth the size that scholars estimate, they would still account for more than 20 percent of the total consumer cost of federal telecommunications regulation.

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1. Introduction

If U.S. spectrum policy were significantly more market-based, would consumers notice? Could the benefits to consumers, or to society as a whole, be large enough to justify the political effort?

Economic research suggests that the answer is a resounding yes. During the past two decades, U.S. spectrum policy has gradually become more market-oriented. Consumers have reaped significant benefits as a result. Nevertheless, current policy still generates large inefficiencies by preventing reallocation of spectrum to its most highly-valued uses – most likely wireless voice and data communications.

The costs of current policy are large in an absolute sense, in the neighborhood of $77 billion or more annually. Spectrum allocation is by far the costliest aspect of U.S. federal telecommunications regulation, and it represents a very large share of the total. Even if the actual costs of U.S. spectrum allocation policy were only one-tenth the size that scholars estimate, they would still account for more than 20 percent of the total consumer cost of telecommunications regulation.

Clearly, spectrum policy is a topic that deserves significant attention from scholars and policymakers.

2. The Theory: Effects of Economic Regulation

Theory on the effects of economic regulation is voluminous and largely well-understood. A brief review of theory, however, is useful to clarify precisely what kinds of costs are included in the figures that follow.

Price regulation can improve consumer welfare when the regulated firm has monopoly power. If the firm charges a price that exceeds the price it would charge if it faced competition, ideal regulation can mimic some of the effects of competition by forcing the firm to charge the “competitive” price.¹ The Telecommunications Act of 1996 assumes

¹ For the sake of simplicity, this discussion speaks of the “competitive” price in the same sense as most introductory economics textbooks—as a single price charged by a firm whose behavior is constrained by the presence of competitors. By assumption, the competitive firm must be as efficient as possible, or else it would have been displaced by competitors. Also by assumption, competition is sufficiently strong that the firm cannot raise price or earn profits that exceed its cost of capital.

In an industry such as telecommunications, which is undergoing rapid technological change, the concept of the “competitive” price is somewhat more complicated, for several reasons. First, technological improvements mean that prices are likely to fall over time; thus, it is more accurate to speak of a competitive price path rather than a single competitive price. Second, diverse consumer wants can lead to product differentiation; in such a situation, the “competitive” price is actually a set of prices for different products and services that are not perfect substitutes. Third, the possibility of innovation creates substantial uncertainty about how much consumers are willing to pay for a service, and for how long. This uncertainty requires a higher level of profit to elicit investment than would be required in the absence of uncertainty. For these reasons, “the competitive price” of a telecommunications service or facility is likely to be a range of price paths which differ from the price that would be observed in a relatively stable, regulated market.
competition is possible and desirable in all markets. In some cases, it directs the FCC to promulgate regulations that are intended to move the industry from monopoly to competition, rather than substitute regulation for competition. To the extent that such regulations accomplish this goal, they should have a similar effect on consumers as ideal regulation, reducing price and increasing the amount of service purchased. In addition, the move from monopoly to competition could produce other consumer benefits that regulation rarely delivers, such as innovative new services.

Ideal regulation is supposed to make consumers better off by producing a price equal to the competitive market price. However, there is no guarantee that this will occur in practice. There are least five reasons, all of them highly relevant to telecommunications:

- Prices below competitive market levels can create shortages
- Regulation can hold prices above costs
- Regulation and monopoly inflate costs
- Regulation stifles innovation and entrepreneurship
- Expenditures to acquire and maintain wealth transfers increase costs

**Below-competitive prices**

If regulators set prices below the competitive level, they create shortages. History suggests that regulators frequently succumb to this temptation. The temptation is especially strong in capital-intensive industries that require high up-front investments that have few good alternative uses. After the investment is made, public policy can reduce prices below the competitive level without immediately creating a shortage, as long as the price is high enough to cover the firm’s ongoing costs of operation. Such prices harm consumers in the long run, because firms will refrain from investing if they expect the unremunerative prices to continue. Eventually, this reduction in investment creates shortages, deteriorations in the quality of service, or other problems that diminish consumer welfare.

**Above-competitive prices**

Price and entry regulation imposed on a competitive industry can actually increase prices and reduce consumption. This can occur either because policymakers imposed regulation on a competitive industry mistakenly, or because they consciously did so in response to political incentives.

Political incentives to regulate a competitive industry could come from the industry itself, which may seek regulation in order to forestall competition and increase profits. But political pressures may also come from certain segments of customers, who use regulation to obtain service at subsidized rates, with the subsidies funded through

To keep the language simple, though, this study will continue to use the term “competitive price” to refer to this more complicated, dynamic collection of prices.
excessive charges imposed on other consumers.\(^2\) The history of telecommunications, as well as the actual structure of telecommunications regulation, suggests that policymakers have responded to both types of political pressures. Traditionally, telecommunications regulation created market power, then mandated that some of the monopoly overcharges must be used to make local residential phone service available at prices that failed to cover incremental costs. Regulation thus became an opaque way of taxing some services to fund a highly visible “free lunch.”\(^3\)

When regulation elevates prices above costs, it reduces consumer welfare both by increasing price and by reducing output. Cross-subsidies can reduce producer welfare as well. If a monopolist is allowed to overcharge and use the money to fund cross-subsidies, the firm sacrifices some or all of the inflated profits. If regulators force competing firms to overcharge consumers and then hand the money to some other firm to subsidize its service, the firms forced to collect the excess charges will see their sales and profits fall in response to the price increase. (This latter example may appear fanciful in the abstract, but it happens quite frequently in telecommunications regulation.)

**Inflated costs**

Cost-of-service regulation often distorts the regulated firm’s choice of inputs, so the regulated firm fails to produce at minimum cost. The resulting rates might be considered “just and reasonable,” because they reflect costs, but the costs themselves are inflated.\(^4\) Competition creates pressure for firms to squeeze out unnecessary costs and provide a combination of price and quality that consumers prefer. Where monopoly is expected to persist, both federal and state telecommunications regulators have increasingly opted for “price cap” regulation, which caps the prices firms can charge but allows them to earn additional profits by cutting costs.

**Stifled innovation and entrepreneurship**

Empirical studies frequently find that economic deregulation generates larger price reductions and consumer benefits than economists predicted based on pre-deregulation costs and market conditions.\(^5\) Such findings underscore the importance of innovation and

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entrepreneurship in improving economic welfare. As Winston (1998:91) noted, “Predictions of the effects of deregulation were generally guided by static models that assumed technology and operations would not be significantly affected by the change in the regulatory regime.”6 Regulation diminishes entrepreneurial incentives to lower costs, improve quality, and develop new products and services.

Regulatory constraints on profits reduce the rewards for risky but potentially valuable innovation. In theory, regulators could prevent this problem by permitting the firm to earn a sufficient risk premium. In practice, regulators face a continual temptation to disallow the risk premium once an innovation is introduced and proven successful, because the successful innovation will likely remain in place even if regulation reduces its profitability. After the fact, it is often difficult to distinguish between high profits resulting from innovation and high profits resulting from market power. Expropriating these profits, however, reduces incentives for future innovation. And if profit regulation removes the carrot, protected markets remove the stick—the competitive threat that could otherwise spur entrepreneurship.7

In addition to altering incentives for discovery, economic regulation short-circuits the market’s normal trial-and-error process. Real-world competition is a dynamic process of trial and error. Competition reveals what services, costs, and prices are possible.8 As Justice Breyer noted in his dissent in Iowa Utilities Board, a key case interpreting the Telecommunications Act of 1996, “The competition that the Act seeks is a process, not an end result; and a regulatory system that imposes through administrative mandate a set of prices that tries to mimic those that competition would have set does not thereby become any the less a regulatory process, nor any the more a competitive one.”9 In the absence of competition, we do not know for sure what services, costs, and prices are possible.10

Regulation can also stifle innovation more directly, when firms must obtain regulators’ permission before entering new markets or offering new services. In some cases, firms must wait for regulators to establish the legal or institutional framework before they can deploy a new technology.11 The opportunity in question may be something that is quite well understood, and regulation poses the only barrier to capitalizing on the

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9 Iowa Utilities Board, 119 S. Ct. at 749-50 (Breyer, J. concurring in part and dissenting in part).
10 In a very static industry, historical costs may be a useful guide for calculating “competitive” prices. In a dynamic industry, though, attempts to estimate competitive prices that do not actually exist will be fraught with error.
opportunity.\textsuperscript{12} Alternatively, the perceived opportunity may be more of a hunch or conjecture. Such a perceived opportunity must be tested in a competitive process of trial and error before the entrepreneur can judge whether the opportunity is real or illusory.\textsuperscript{13} In this case, regulation indirectly prevents firms from seizing new opportunities because it prevents or discourages experimentation. The ten-year delay in allowing local Bell telephone companies to offer voice mail, for example, cost consumers approximately $1.27 billion annually in forgone benefits, and regulation-induced delay in the introduction of cell phone service cost consumers $50 billion annually.\textsuperscript{14}

\textit{Expenditures to acquire/maintain wealth transfers}

Whether it curbs or creates market power, regulation transfers wealth. The fact that regulation is a means of transferring wealth also implies another effect on the welfare of both consumers and the regulated industry. When wealth transfers are available, organized interests will expend resources to obtain them. Regulated firms will spend money to retain monopoly profits, or to protect themselves from below-competitive prices that expropriate their assets. From a society-wide perspective, money spent purely to capture wealth transfers is often considered pure waste. In some circumstances, the total amount of money wasted may even exceed the size of the wealth transfer.\textsuperscript{15}

3. **Accounting for Regulatory Costs**

Ideal economic regulation benefits consumers by reducing prices to competitive levels. In reality, economic regulation may harm consumers by holding prices below competitive levels, raising prices above competitive levels, increasing costs, reducing innovation, or turning wealth transfers into social waste. Identifying which of these things have occurred in practice is the key to assessing the costs and consequences of economic regulation. In practice, it is often easier for scholars to identify price changes, wealth transfers, and their consequent effects than to identify forgone opportunities to cut costs or introduce new innovations. As a result, most empirical economics literature on the costs of telecommunications regulation focuses on identifying price distortions, wealth transfers, and the associated reductions in consumer and producer surplus.

\textit{Cost Categories}

Regulatory costs can be classified into several categories:

- **Wealth transfers:** Traditionally, economists have not regarded such transfers as a cost of regulation, because one party’s loss is another party’s gain. However, if

\textsuperscript{12} Kirzner 1985: 141.
the transfer process itself is wasteful, or if firms expend resources to capture or defend themselves from wealth transfers, then some or all of the transfer is a cost.

- **Forgone consumer surplus:** When regulation raises costs or prices, consumers use less of the regulated service, and they are worse off as a result.

- **Total cost to consumers:** This is the sum of the wealth transfer extracted from consumers plus the forgone consumer surplus. If some of the wealth is then redistributed to consumers, it is counted as a beneficial outcome. Estimating the net effect on consumers requires a comparison of the total cost to consumers with the value of any wealth transfers or other benefits that consumers receive.

- **Forgone producer surplus:** When prices inflated by regulation prompt consumers to use less of a service, producers sell less of it.

- **Value of forgone output:** This is the sum of forgone consumer surplus and forgone producer surplus that occurs when regulation reduces consumption by raising prices. Empirical studies frequently calculate this total sum rather than breaking it up into the consumer and producer surplus components. Borrowing a term from public finance, the value of forgone output can also be called the “excess burden” of the regulation, analogous to the excess burden of taxation.

- **Wealth transfer plus forgone output:** This is the widest measure of the cost of regulation. It truly counts as a measure of social cost if all of the wealth transfer is wasted. To the extent that the wealth transfer is not wasted, adding the wealth transfer to the forgone output overstates the cost of regulation.

In some cases, these costs emerge simply because regulators set prices above or below competitive levels. In other cases, wealth transfers and forgone value occur because of regulation’s more complicated effects on cost levels, innovation, and entrepreneurship. The particular factors that underlie estimates of regulatory costs will vary depending on the service studied, the nature of the regulation, and the analytical method chosen by the authors of a particular study.

**Cost Estimates**

In theory, the easiest cost of regulation to identify is the money spent to run the FCC. FCC outlays totaled $351 million in fiscal 2003 and are estimated at $361 million for fiscal 2004.  

16 In addition to the direct cost to taxpayers, these expenditures create an indirect cost: the reduction in economic output that occurs because of the taxes necessary to raise the revenues. The value that this lost output would have created for consumers and

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producers is called the “excess burden” of the tax. Economic research suggests that
general taxation usually involves an excess burden of 25-40 cents per dollar raised.\textsuperscript{17}
Therefore, the taxes necessary to raise funds for FCC expenditures generate an excess
burden of approximately $90-144 million, for a total cost of $451-505 million.

FCC outlays, which reflect appropriations, may either over- or under-state the FCC’s
expenditures on telecommunications and broadband regulation. The FCC’s appropriation
covers other regulatory initiatives, such as broadcasting, that are outside the scope of this
study. On the other hand, the FCC receives revenues from the public in addition to
appropriations, such as revenues from spectrum license auctions, interest on loans to
spectrum buyers, penalties, and forfeitures. It retains some of these revenues to cover its
costs.

The FCC’s \textit{Performance and Accountability Report} provides an alternative estimate of
federal expenditures on the regulations covered in this paper. The report breaks costs
down by strategic goal. The first three strategic goals—broadband, competition, and
spectrum—cover most of the regulations in this paper. The combined net cost of these
three programs is approximately $1.2 billion.\textsuperscript{18} (This figure excludes revenues and costs
for the Universal Service Fund.) Obviously, not all of this is financed by appropriations.
If the excess burden associated with the non-appropriated funds is the same as that of the
appropriated funds, it would total $300-480 million. Total spending plus the excess
burden would be $1.5-1.7 billion.

These are big numbers. But the costs that flow from FCC regulations far exceed the
FCC’s expenditures. Economic regulations generating major costs include:

- Long-Distance Access Charges
- Universal Service Funding
- Local Number Portability
- Enhanced 911 Service
- Miscellaneous Wireless Mandates
- Spectrum Management
- Satellite
- Unbundled Network Elements
- Resale of Incumbent’s Services
- Broadband

\textsuperscript{17} Jerry Hausman, “Efficiency Effects on the U.S. Economy from Wireless Taxation,” \textit{National Tax
The table below, drawn from a recent extensive literature review, summarizes the costs of these regulations. The research covered includes studies published in academic journals and books, academic working papers, and FCC reports. It includes studies sponsored by industry or advocacy organizations only when they offer novel information, data unavailable elsewhere, or empirical analysis based on academic work. Where no recent empirical studies were available, the table includes the author’s back-of-the-envelope calculations employing recent data and based on established methodologies.

All of the figures in the table are gross cost estimates. Estimates of the net effect of these regulations would have to take into account any benefits the regulations produce. Some of the wealth transfers, for example, flow between different groups of consumers, and so a conventional cost/benefit analysis would count the portion that makes it back to some consumers as a benefit that could partially offset the cost to other consumers. Some of the mandated services or functionalities may also confer benefits either on groups of consumers or on society as a whole. A full treatment of benefits as well as costs can be found in Ellig (2005). The focus here is solely on costs, in order to ascertain relative importance of costs created by spectrum management versus costs created by other regulations.

Federal telecommunications and broadband regulations have significant costs. Excluding the FCC’s monetary outlays, these regulations cost consumers $25 billion annually in forgone consumer surplus, or as much as $105 billion if one includes the wealth transfers as a cost. Total deadweight loss is approximately $41 billion. If all of the wealth transfer is counted as a cost, the total social cost is approximately $120 billion.20

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20 The total figures are simply sums of the costs of individual regulations; thus, they ignore any interactions between regulations.
Costs of Federal Telecommunications and Broadband Regulation

<table>
<thead>
<tr>
<th>Regulation</th>
<th>Outlays or Wealth Transfer</th>
<th>Forgone Consumer Surplus</th>
<th>Total Cost to Consumers</th>
<th>Value of Forgone Output</th>
<th>Wealth transfer Plus Forgone Output</th>
<th>Excess Burden Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>FCC outlays 2004</td>
<td>$361,000,000</td>
<td>N.A.</td>
<td>N.A.</td>
<td>$144,000,000</td>
<td>$505,000,000</td>
<td>40</td>
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<tr>
<td>FCC net cost of 3 strategic goals</td>
<td>$1,200,000,000</td>
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<td>N.A.</td>
<td>$480,000,000</td>
<td>$1,680,000,000</td>
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<td>Interstate Long-Distance Access Charges 2002</td>
<td>$3,300,000,000</td>
<td>$300,000,000</td>
<td>$3,600,000,000</td>
<td>$1,450,000,000</td>
<td>$4,750,000,000</td>
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<td>Universal Service Contributions</td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Interstate Long-Distance 2002</td>
<td>$2,700,000,000</td>
<td>$240,000,000</td>
<td>$2,940,000,000</td>
<td>$1,160,000,000</td>
<td>$3,860,000,000</td>
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<tr>
<td>Wireless 2003</td>
<td>$1,400,000,000</td>
<td>$39,000,000</td>
<td>$1,439,000,000</td>
<td>$873,000,000</td>
<td>$2,273,000,000</td>
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<td>International</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
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<tr>
<td>Local Number Portability</td>
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<tr>
<td>Wireline 2003</td>
<td>$762,000,000</td>
<td>0</td>
<td>$762,000,000</td>
<td>0</td>
<td>$762,000,000</td>
<td>0</td>
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<td>Wireless 2003</td>
<td>$952,000,000</td>
<td>$26,000,000</td>
<td>$978,000,000</td>
<td>$594,000,000</td>
<td>$1,546,000,000</td>
<td>62</td>
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<tr>
<td>Enhanced 911</td>
<td></td>
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<tr>
<td>Wireline 2003</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
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<tr>
<td>Wireless 2003</td>
<td>$1,200,000,000</td>
<td>$32,000,000</td>
<td>$1,232,000,000</td>
<td>$725,000,000</td>
<td>$1,925,000,000</td>
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<tr>
<td>Miscellaneous Wireless</td>
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<td></td>
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<td></td>
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<tr>
<td>Number Pooling 2003</td>
<td>$324,000,000</td>
<td>$9,000,000</td>
<td>$333,000,000</td>
<td>$202,000,000</td>
<td>$526,000,000</td>
<td>62</td>
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<td>CALEA 2003</td>
<td>$457,000,000</td>
<td>$13,000,000</td>
<td>$470,000,000</td>
<td>$285,000,000</td>
<td>$742,000,000</td>
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<td>Spectrum Management 2004</td>
<td>$54,000,000,000</td>
<td>$23,400,000,000</td>
<td>$77,400,000,000</td>
<td>$30,000,000,000</td>
<td>$84,000,000,000</td>
<td>56</td>
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<tr>
<td>Satellite</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
<td>N.A.</td>
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<tr>
<td>Telephone Unbundling</td>
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<tr>
<td>Unbundled Net. Elements 2003</td>
<td>$9,700,000,000</td>
<td>$1,400,000,000</td>
<td>$11,100,000,000</td>
<td>$5,900,000,000</td>
<td>$15,600,000,000</td>
<td>61</td>
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<td>Resale 2003</td>
<td>$21,000,000</td>
<td>$6,911</td>
<td>$21,006,911</td>
<td>$14,000,000</td>
<td>$35,000,000</td>
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</tr>
<tr>
<td>Broadband Unbundling 2003</td>
<td>N.A.</td>
<td>N.A.</td>
<td>$4,500,000,000</td>
<td>N.A.</td>
<td>$4,500,000,000</td>
<td>N.A.</td>
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<tr>
<td>Total</td>
<td>$76,016,000,000</td>
<td>$25,459,006,911</td>
<td>$104,775,006,911</td>
<td>$41,683,000,000</td>
<td>$122,199,000,000</td>
<td></td>
</tr>
<tr>
<td>Total excluding FCC spending</td>
<td>$74,816,000,000</td>
<td>$25,459,006,911</td>
<td>$104,775,006,911</td>
<td>$41,203,000,000</td>
<td>$120,519,000,000</td>
<td></td>
</tr>
<tr>
<td>Total excluding spectrum and FCC spending</td>
<td>$20,816,000,000</td>
<td>$2,059,006,911</td>
<td>$27,375,006,911</td>
<td>$11,203,000,000</td>
<td>$36,519,000,000</td>
<td></td>
</tr>
</tbody>
</table>

Italicized figures in each column are the same because estimates for some items that would make them different are unavailable. N.A. = Not available.
The FCC spent $1.2 billion at most to administer these regulations in fiscal 2004. The taxes necessary to raise this money reduced social welfare by up to $480 million, for a maximum total cost of $1.7 billion. The cost of regulation to consumers is more than 60 times this amount.

Dollar for dollar, economic regulation of telecommunications harms economic welfare more than taxation. The table calculates the excess burden of each regulation by dividing the value of foregone output by the wealth transfer. Almost all regulations examined in this study entail a higher “excess burden” than the taxation necessary to raise the same amount of revenue. Spectrum allocation is no exception, with an estimated excess burden of 56 cents for every dollar of wealth transferred.

The regulations in the table can be grouped into four categories: barriers to entry, taxes and subsidies, mandated functionalities, and network sharing. The types of costs and benefits associated with each category are somewhat different.

**Barriers to entry**, as the name implies, are regulations that prevent firms from entering a market or offering a service without FCC permission. Because the federal government controls access to electromagnetic spectrum and orbital satellite slots, federal policies allocating these scarce resources can serve as barriers to entry. By constraining competition and raising prices, they create wealth transfers from consumers to incumbent firms; the associated prices increases also generate substantial allocative inefficiencies, since these services tend to have high price elasticities of demand. There is a substantial amount of research on the effects of spectrum regulation, but virtually none on the effects of satellite regulation.

**Tax and subsidy** regulations inflate the price of some services in order to subsidize the price of other services. Some, such as long-distance access charges and other intercarrier compensation, are classic hidden cross-subsidies. Others, such as mandatory universal service contributions collected from interstate telecommunications services, are more explicit. Some of the Universal Service Fund pays for cross-subsidies to low-income users and rural telephone companies, but part subsidizes Internet service to schools and libraries. Most of the taxed services have relatively high price elasticities of demand. The bulk of the subsidies go to local wireline phone service, which has a low if not zero elasticity of demand in the U.S. Therefore, the tax and subsidy programs create large welfare losses in addition to the wealth transfers.

**Mandated functionalities** occur when regulation requires carriers to provide consumers with specified services, or requires them to install particular capabilities in their networks. Examples include number portability, number pooling, 911 service, and wiretapping capabilities required by the Communications Assistance to Law Enforcement Act (CALEA). These impose costs that consumers may or may not have been willing to bear in the absence of regulation. Consumers or society at large may also receive some benefit as a result of the mandate.

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21 The figure thus represents the average excess burden of each regulation per dollar of wealth transfer – not the marginal burden associated with the last dollar of wealth transfer.
**Network sharing** requirements occur when network owners, typically established incumbents, must share their networks with competitors at regulated prices. In the U.S., such requirements have applied to the incumbent local phone companies’ local networks; they must lease competitors parts of their networks and also make their local service available to competitors at a wholesale discount. Network sharing has also applied in the past to some phone company facilities used to provide DSL broadband service. It could be applied more broadly to both DSL and cable modem service, depending on the results of several regulatory proceedings and court cases. To the extent that network sharing moves prices from monopoly to competitive levels, it redistributes rents from incumbents to consumers and increases efficiency. To the extent that it reduces prices below competitive levels, it discourages efficient competition and may stunt the incumbent’s incentives to invest in maintaining or upgrading the network. If network sharing creates or perpetuates below-competitive prices for services that receive cross-subsidies, it creates an opportunity cost, because regulators could instead have increased welfare by using rents to reduce the prices of the services that were taxed to supply the subsidies.  

4. Relative Importance of Spectrum Management

One of the most striking features of the cost totals is the huge proportion accounted for by spectrum management. Spectrum management is by far the most costly regulation. FCC spectrum management policy costs consumers at least $77 billion in higher prices and forgone wireless services. Spectrum management accounts for:

- 72 percent of the wealth transferred by federal telecom regulation
- 92 percent of the consumer surplus forgone due to federal telecom regulation
- 74 percent of the total cost to consumers due to federal telecom regulation
- 73 percent of the total deadweight loss due to federal telecom regulation

**Basic Structure of FCC Spectrum Management**

How does spectrum management achieve this notable distinction? The FCC manages and allocates portions of the electromagnetic spectrum used by parties other than the federal government. Technically, the FCC does not assign, allocate, auction, or license spectrum. Rather, it licenses devices that use various portions of the spectrum. FCC spectrum policy affects telecommunications competition and consumer welfare in two ways. First, an FCC rulemaking determines the amount of spectrum that can be used for a given purpose, such as broadcasting or wireless communications, and myriad other details. Second, the FCC’s method for issuing licenses to use spectrum determines who receives licenses, and how quickly.

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23 The rulemaking “defines the service allowed, what business model that business will be conducted under (common carrier, private carrier, broadcaster, etc.), technical standards, the number of competitors in the marketplace, geographic size of licenses, terms of license renewal and license transfer, and myriad business
A major improvement in spectrum management occurred when Congress authorized the FCC to auction licenses in 1993. Prior to 1981, the FCC decided whose equipment could use which spectrum through “comparative hearings.” In 1981, Congress authorized the FCC to allocate licenses through lotteries. The methods used to award licenses prior to auctions cost consumers billions of dollars due to delayed adoption of wireless communications services.\(^{24}\) Lottery entrants, for example, had to manufacture applications that “proved” they were qualified to operate wireless telecommunications systems, at a cost of $500 million-$1 billion between 1986 and 1989. (Most licenses awarded by lottery were then resold.) Auctions eliminated such waste.\(^{25}\) The first license auctions occurred 34 years after they were proposed by Nobel Laureate Ronald Coase, who was asked by an FCC commissioner when he testified before on his proposal before the FCC in 1959, “Is this all a big joke?”\(^{26}\)

Spectrum has not, however, been privatized; the auction winners simply get to operate equipment that uses the spectrum for specified purposes.\(^{27}\) Formally, spectrum is owned in common by the American public, and the FCC merely regulates its use by issuing licenses.\(^{28}\) The design and implementation of license auctions has generated substantial scholarly research and commentary, often focused on whether the design of the auction ensures that each license will go to the bidder that values it most highly. Aspects of the FCC’s auction design have generated substantial criticism, but there appears to be a general consensus among researchers that auctions are a vast improvement over prior methods of awarding licenses.\(^{29}\)


\(^{27}\) As 37 prominent economists noted several years ago, “[A]uctions for licenses have not changed the underlying system of spectrum allocation. Radio frequencies are allocated to services by an FCC rule making. The opportunity cost of spectrum is evaluated not by market participants but by regulators. With few exceptions, spectrum continues to be offered to the market only as allocated and no price can be offered to reallocate it from the officially designated use.” “Comments of 37 Concerned Economists,” In the Matter of Promoting Efficient Use of Spectrum Through Elimination of Barriers to the Development of Secondary Markets, WT Docket No. 00-230 (Feb. 7, 2001): 3. “Indeed, to be issued an FCC license, an applicant must first certify that it will not assert any propertyed interests in radio spectrum. This is so fundamental to U.S. communications law that it predates the 1927 Radio Act, being enacted in Senate Joint Resolution 125, signed into law by President Calvin Coolidge on Dec. 8, 1926.” Hazlett (2001): 102.


Spectrum management policy, however, continues to generate substantial consumer costs. Licenses have become somewhat more flexible in recent years. Nevertheless, FCC decisions rather than market transactions determine the general uses to which various blocks of spectrum will be put. Defense and local government get to use large blocks of spectrum for free, and as a result such spectrum is often used inefficiently. As the FCC’s Spectrum Policy Task Force noted:

As a general proposition, flexibility in spectrum regulation is critical to improving access to spectrum. In this context, “flexibility” means granting both licensed users and unlicensed device operators the maximum possible autonomy to determine the highest valued use of their spectrum, subject only to those rules that are necessary to afford reasonable opportunities for access by other spectrum users and to prevent or limit interference among multiple spectrum uses…In most cases, a flexible use approach is preferable to the Commission’s traditional “command and control” approach to spectrum regulation, in which allowable spectrum uses are limited based on regulatory judgments.

The FCC affects the price of wireless telephone and data services by determining how much spectrum can be used for each service. The fact that spectrum users must now purchase licenses through auctions does not increase the prices consumers pay for wireless services; auctions merely allow the government to collect some of the profit


30 “…[T]he Commission has never permitted an existing licensee to voluntarily discontinue providing the service for which it was licensed and provide a completely different service with the spectrum that was occupied by the old service.” Evan Kwerel and John Williams, “A Proposal for a Rapid Transition to market Allocation of Spectrum,” FCC, Office of Plans and Policy Working Paper No. 38 (Nov. 2002): 2. See also Arthur De Vany, “Implementing a Market-Based Spectrum Policy,” Journal of Law & Economics 41:2 (Oct. 1998): 627-46.


from the firms using the spectrum. But by creating an artificial scarcity of spectrum, a critical input, regulators increase the prices that wireless firms can charge consumers by reducing the supply of wireless services and inhibiting competition. These price increases and resulting consumer welfare losses would occur regardless of whether the FCC awarded licenses through auctions, hearings, or lotteries.

The explosive growth of wireless service in the 1990s demonstrates how spectrum policy can have large effects on consumer welfare. In the 1980s, the federal government licensed only two cellular providers in each market. In 1993, Congress directed the FCC to begin to auction spectrum, and the FCC responded by auctioning almost twice as much spectrum as it had already allocated to cell phone service, effectively making room for at least six wireless providers.

Between 1984 and 1995, when there were just two cell phone companies per market, inflation-adjusted rates fell by an average of between three and four percent annually. Entry of new competitors prompted price reductions averaging 17 percent annually between 1995 and 1999. More recent trends show up in the U.S. Bureau of Labor Statistics’ index of wireless telecommunications prices, which begins in 1997. During the past six years, inflation-adjusted wireless prices have fallen by approximately 40 percent. The value that wireless telephone service has created for consumers is truly staggering. One estimate suggests that consumers valued the first generation of cell phone service at $50 billion per year.

Currently, approximately 170 MHz of radio spectrum are used for wireless service. Some additional spectrum is currently unused because it was purchased when the FCC auctioned 120 MHz of spectrum for wireless in 1994, but the winning bidders went bankrupt and the spectrum was tied up in bankruptcy proceedings. The FCC regained some of these licenses and re-auctioned them in January 2005.

Various FCC reports have identified between 183 and 438 MHz of unused or little-used spectrum that could be reallocated for mobile phone, fixed wireless telephony, and wireless broadband. Even the larger figure represents only 23 percent of the most valuable spectrum.

**Estimated Costs of Spectrum Management**

The cost estimates in the table are based on a 2004 study by Hazlett et. al., which in turn utilizes empirical findings from Hazlett and Muñoz (2004). The latter paper employed

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37 Kwerel and Williams (2002).
international data to estimate a relationship between the amount of spectrum available for wireless service and market structure, as measured by the Herfindahl-Hirschmann Index (HHI). They found that both the quantity of spectrum and the HHI affect wireless revenues per minute, a proxy for price. Combining these two relationships with a measure of the elasticity of demand, it is possible to calculate how a change in the amount of spectrum for wireless service affects prices, consumer welfare, and deadweight loss.\(^{38}\)

Hazlett et. al. estimate the effect on consumer welfare of reallocating up to 200 MHz of U.S. spectrum to mobile phone service. Industry sources have suggested that 200 MHz would be needed to complete nationwide rollout of “third generation” wireless services. The per-minute price of wireless service would fall by 50 percent, generating an increase in consumer welfare of $77.4 billion per year.\(^{39}\)

From the data and results in their study, one can also approximate the separate effects on consumers and producers. A 50 percent price reduction would save consumers approximately $54 billion annually on the 966 billion minutes they used in 2003.\(^{40}\) That leaves $23.4 billion in consumer gains from the increased wireless usage that would accompany the price reduction. The increased usage would also increase wireless firms’ net revenues by about $6.5 billion annually, for a total increase in economic welfare (reduction in excess burden) of $30 billion annually.\(^{41}\)

Many wireless firms would, however, be worse off if more spectrum were allocated to wireless, for two reasons. First, $54 billion of the reduction in consumers’ bills would come out of wireless firms’ revenues. Second, since the new licenses would be auctioned, wireless firms would pay the present discounted value of (some or all) of their $6.5 billion in expected new net revenues to the U.S. Treasury. The firms most likely to gain from more liberal spectrum allocation would be new entrants or incumbents that need more spectrum to expand services. This may explain why liberalization has been slow in coming despite the enormous consumer benefits.


\(^{39}\) Hazlett et. al. (2004): 69, 100.

\(^{40}\) Wireless consumers used 966 billion minutes in 2003 (calculated based on data from the Cellular Telecommunications & Internet Association reported in FCC, Annual Report and Analysis of Competitive Market Conditions with Respect to Commercial Mobile Services, WT Docket No. 04-111, released Sept. 28, 2004: paras. 175 and 181). A 5.6 cent per minute price reduction implies that consumers would gain $54 billion in price reductions on the minutes they were already using.

\(^{41}\) The $6.5 billion figure is the difference between the new price of wireless (5.6 cents/minute) and the marginal cost of wireless (5 cents/minute, following Hausman 2000), multiplied by the estimated increase in minutes (using a demand elasticity of 2.32 as calculated in Hazlett and Muñoz 2004, on which the calculations in Hazlett et. al. 2004 are based). Wireless firms lose $54 billion due to the price reduction on the minutes consumers were already using, which is partially offset by a $6.5 billion gain due to the increased number of minutes sold. The total deadweight loss or excess burden associated with the status quo is the forgone increase in consumer surplus ($23.4 billion) plus the forgone increase in producer surplus ($6.5 billion). If the marginal cost of wireless service is less than then 5 cents/minute that Hausman reported in 2000, then the forgone increase in producer surplus, and total deadweight loss, could be much larger.
The strength of the finding that spectrum management accounts for a large percentage of regulatory costs depends in part on the reliability of the cost estimates. This finding appears pretty robust.

Hazlett et al.’s results are based on an international statistical analysis which estimates the elasticity of demand for wireless service of between -1.71 and -3.62. This range exceeds the most recent measures of the elasticity calculated using U.S. data, as well as some earlier international and U.S. estimates. The larger elasticity leads to a larger predicted change in consumer welfare when prices fall.

Even if the true change in consumer welfare is much smaller, that is still billions of dollars—much larger than the effects of most other telecommunications regulations. As the table below shows, spectrum policy accounts for more than two-thirds of the cost of U.S. telecommunications regulation to consumers and society as a whole. If the cost of spectrum management were only half as large, it would still account for more than half of the total cost of telecommunications regulation.

If the cost of spectrum management were only one-tenth as large as Hazlett et al.’s research suggests, it would still account for 20 percent of most types of regulatory costs, and half of the lost consumer surplus. It would sacrifice more consumer surplus than any other regulation. The only other regulation with larger wealth transfers and total deadweight loss would be unbundled network element regulation (and these costs will decline substantially when the unbundled network element platform disappears in 2006). Therefore, the costs of spectrum management would be noteworthy even if they were much smaller than the estimates reported here suggest.

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43 The latter, however, involves substantial wealth transfers from some consumers to others. Spectrum management generally creates wealth transfers from consumers to firms. From a consumer perspective, therefore, spectrum management is clearly the most costly regulation.
Sensitivity analysis: Spectrum policy as a % of all costs of U.S. telecom regulation

<table>
<thead>
<tr>
<th></th>
<th>Wealth Transfer</th>
<th>Forgone Surplus</th>
<th>Total Cost to Consumers</th>
<th>Value of Forgone Consumers</th>
<th>Forgone Plus Forgone Output</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectrum</td>
<td>$54,000,000,000</td>
<td>$23,400,000,000</td>
<td>$77,400,000,000</td>
<td>$30,000,000,000</td>
<td>$84,000,000,000</td>
</tr>
<tr>
<td>Other</td>
<td>$20,816,000,000</td>
<td>$2,059,006,911</td>
<td>$27,375,006,911</td>
<td>$11,203,000,000</td>
<td>$36,519,000,000</td>
</tr>
<tr>
<td>Spectrum %</td>
<td>0.72</td>
<td>0.92</td>
<td>0.74</td>
<td>0.73</td>
<td>0.70</td>
</tr>
<tr>
<td>1/2 spectrum</td>
<td>$27,000,000,000</td>
<td>$11,700,000,000</td>
<td>$38,700,000,000</td>
<td>$15,000,000,000</td>
<td>$42,000,000,000</td>
</tr>
<tr>
<td>Other</td>
<td>$20,816,000,000</td>
<td>$2,059,006,911</td>
<td>$27,375,006,911</td>
<td>$11,203,000,000</td>
<td>$36,519,000,000</td>
</tr>
<tr>
<td>Spectrum %</td>
<td>0.56</td>
<td>0.85</td>
<td>0.59</td>
<td>0.57</td>
<td>0.53</td>
</tr>
<tr>
<td>1/10 spectrum</td>
<td>$5,400,000,000</td>
<td>$2,340,000,000</td>
<td>$7,740,000,000</td>
<td>$3,000,000,000</td>
<td>$8,400,000,000</td>
</tr>
<tr>
<td>Other</td>
<td>$20,816,000,000</td>
<td>$2,059,006,911</td>
<td>$27,375,006,911</td>
<td>$11,203,000,000</td>
<td>$36,519,000,000</td>
</tr>
<tr>
<td>Spectrum %</td>
<td>0.21</td>
<td>0.53</td>
<td>0.22</td>
<td>0.21</td>
<td>0.19</td>
</tr>
</tbody>
</table>

There are several reasons that the foregoing figures might actually underestimate the inefficiencies associated with U.S. spectrum management. The estimate involves only 200 MHz of spectrum and assumes it would be used for wireless telephony, since the principal data available are data on wireless telephony use and pricing. At least several hundred more MHz are likely available, and these could also be used for broadband or for fixed wireless to provide the “last mile” of local telephone service.

Unfortunately, no estimates of the impact of such increases in competition or consumer welfare are available. Most attempts to measure the elasticity of demand for broadband have found that it is highly elastic, ranging from -1.5 to -3.76.44 If wireless broadband reduces prices, relatively large increases in consumer welfare would likely result.

Net costs are likely high

All of the foregoing figures are gross costs that do not include any offsetting benefits. A calculation that includes benefits, however, would likely find that the net costs of spectrum management are quite high, and perhaps even larger as a proportion of the total net cost of telecommunications regulation. This is because there is little evidence of benefits from having regulators, rather than markets, decide how spectrum will be used.

In the past, having the FCC allocate spectrum to various uses was purported to advance several policy outcomes. These include promotion of the “public interest,” promotion of consumer welfare, and prevention of signal interference when different parties try to use the same frequency at the same time.

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At least in the FCC context, the “public interest” implies no specific outcome. A number of FCC chairmen, general counsels, and legal experts have noted that the “public interest” standard means precisely what its author, Sen. C.C. Dill, said it meant: “It covers just about everything.” Thus, the public interest standard is too broad to provide a definition of specific outcomes that FCC spectrum allocation policy might be intended to affect.

Another possible outcome is promotion of consumer welfare (as opposed to the welfare of the regulated industry). However, the research cited above suggests that FCC spectrum allocation often reduces consumer welfare by reducing competition. Consumers benefit when license holders have more flexibility to choose which services they will offer, which technologies they will employ, and which business model they will follow. The more flexibility license holders have to use spectrum as they see fit, the more competitive are the markets for services that use the spectrum. Consumers receive more service at lower prices, and license holders pay less for licenses because restrictions on the uses of spectrum no longer protect license holders from competition. Empirical research using data from more than 1,400 license auctions in 27 countries finds that liberal policies allowing license holders to determine services, technologies, and business models reduce the price paid for licenses by 38 percent. A more liberal spectrum regime is also associated with lower retail prices for wireless service.

The classic argument for government ownership of the airwaves, and administrative allocation of licenses to use spectrum, was that regulation is needed to prevent interference between parties attempting to use the same frequency. A “chaotic” period in 1926, when 200 new radio stations were established and operators used any power or frequencies they desired, is often cited as proof. However, the chaos during that period resulted from court interpretations of the 1912 Radio Act, which prevented the Commerce Department from issuing exclusive licenses for particular wavelengths in order to prevent interference. The problem during that period was the absence of any method for assigning exclusive use of frequencies to prevent interference. The 1927 act establishing the Federal Radio Commission allowed the commission to prevent interference, but also gave it the discretion to award licenses only when “the public interest, necessity, or convenience would be served” and prohibited licensees from asserting any ownership claim over the airwaves. Regulators could prevent interference by issuing licenses to use particular frequencies without specifying how much of which frequency bands must be devoted to which types of services.

Avoiding interference cannot be an outcome attributed to U.S. spectrum allocation policies. But spectrum misallocation is clearly a cost of having the government decide how spectrum will be used. Thus, there is no benefit to offset the substantial cost.

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46 Four countries—Australia, New Zealand, Guatemala, and El Salvador—leave these decisions to the license holder rather than the regulator. See Hazlett and Muñoz (2004).
5. Conclusion

The U.S. experience shows that the costs of spectrum misallocation are large, both in absolute terms and as a proportion of the total costs of telecommunications regulation. The figures are even large if one excludes wealth transfers from the cost totals.

The costs of current spectrum allocation policy can be expected to fall sometime after 2006, if the FCC carries through on its plan to auction an additional 90 MHz of spectrum in that year.\(^{48}\) Nevertheless, the multi-billion dollar figures cited in this paper should only be taken as a rough approximation of the negative effects of spectrum allocation policy on consumer welfare. A truly market-based approach would allow market transactions to allocate spectrum rather than licenses. Potential users could buy or lease spectrum, then choose how to use it. The amount of spectrum allocated to wireless telephone, broadcasting, broadband, and other services would be determined by market transactions and decisions of users, rather than regulatory proceedings. As Ronald Coase noted in 1959,

Certainly, it is not clear why we should have to rely on the Federal Communications Commission rather than the ordinary pricing mechanism to determine whether a particular frequency should be used by the police, or for a radiotelephone, or for a taxi service, or for an oil company for geophysical exploration, or by a motion-picture company to keep in touch with its film stars or for a broadcasting station. Indeed, the multiplicity of these varied uses would suggest that the advantages to be derived from relying on the pricing mechanism would be especially great in this case.\(^{49}\)

Under market-based allocation, the FCC, courts, or other government body would still have a significant role in preventing signal interference, but they would not decide which bits of spectrum could be used for which purposes. In theory, an accurate measure of the effects of spectrum policy would compare the effects of current allocations to the effects of the allocations that a competitive market with stronger property rights might be expected to produce. Given the documented tendency of economic research to under-estimate ex ante the effects of deregulation and competition, the actual benefits of market-based spectrum allocation in the United States could be truly staggering.


\(^{49}\) Coase (1959): 16.