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Granting Licensed Spectrum Flexibility: How to Spur Economic Growth and Innovation in America

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Abstract:

This paper proposes that the Federal Communications Commission adopt rules to allow practically all spectrum to be allocated flexibly in response to market conditions and to allow licensees to use their spectrum flexibly. This approach is consistent with the direction of FCC decisions to allow greater spectrum flexibility. Greater spectrum flexibility to licensees is economically superior to the FCC's recent proposals for broadcast spectrum auctions. Greater spectrum flexibility would foster greater innovation in American spectrum markets and spectrum transactions as well as stimulate innovation in wireless service and product markets. The overall economic value of flexibility is likely orders of magnitude greater than the \$15 billion in auction receipts over ten years projected from broadcast spectrum auctions.

Introduction and summary

All successful economies in the world have at least two free market principles:

1. Individuals are free both to decide the *use* of assets under their control and to put those assets efficiently to their highest valued use;²
2. Individuals are free to *buy* and *sell* assets.³

With these two principles, resources can be owned by those willing to put them to their highest-valued use. Take away either principle, and resources will languish. Not only are the owners of the resources harmed by the absence of either principle, but so too is everyone in the broader economy. The economic benefits from these principles have been widely recognized since Adam Smith.

In the United States, where we aspire to have the freest of all economies, these principles hold true for practically all assets except one—spectrum. Under current law, the Federal Communications Commission can—and does—regulate who can use spectrum and for what purposes they may use spectrum. Ownership of spectrum is reserved for the federal government, with usage rights or licenses granted at the permission of the FCC. These licenses can be transferred only with the good graces and approval of the FCC.

Although the FCC has made substantial progress in recent years in relaxing usage restrictions for spectrum and granting some ease of specific secondary markets for the transfer of spectrum usage rights, the FCC clings to a command-and-control framework that vests in itself the power ultimately to decide what are acceptable uses of spectrum and who may own spectrum licenses.

Consistent with law, the FCC could and should adopt a more market-based approach to spectrum management. I call it “spectrum flexibility.” Spectrum flexibility has two major elements.

1. Consistent with current law, the FCC could continue to manage licenses for spectrum, but licensees could use their spectrum for wireless broadband, satellite services, or even broadcasting.
2. Consistent with current law, licenses could be bought and sold through contracts like other forms of property.

Spectrum flexibility is remarkably simple. It washes away hundreds of pages of obscure and confounding rules written and accumulated over much of the past century to limit the use and transferability of spectrum licenses. Many of these rules serve no economically beneficial purpose today, if they ever did. But the rules do prevent spectrum from being put to its best use.

That is an enormous economic shame. Spectrum is one of our most precious, and most mismanaged, renewable resources. Use of spectrum today does not reduce its availability tomorrow. Unlike solar power or many other forms of renewable energy, spectrum cannot be stored today for use tomorrow. The value of wasted spectrum today is simply lost forever.

Issues of interference among competing spectrum users are common today even with regulation on the use of spectrum. These issues are resolved today either directly among the users themselves, or failing that, at the FCC. Although the frequency of such spectrum interference issues might possibly increase with spectrum flexibility, the mechanisms to resolve them remain in place.

The value of spectrum flexibility to the American economy is substantial, likely in the hundreds of billions of dollars of consumer surplus annually.⁴ Measures of consumer surplus are based on a static technology; entrepreneurs and innovators would likely greet spectrum flexibility with new services and products that are unimaginable today.

The FCC does not lack the legal authority to grant spectrum flexibility. It merely lacks the judgment to do so.

Wireless services built on private investment have driven economic growth in America

In every home, with every school, and at practically every workplace in America, new wireless services have changed how we live, learn, and work. In smartphones and tablets, cellular towers and wireless modems we see the manifestation of the wireless America.

This new wireless world has been created in America and around the globe by individual innovators. Government reports crow about the growth of the wireless world as if government agencies created it. All too often, government agencies impeded the development of the wireless world, particularly in the realm of wireless spectrum markets, and they unwittingly still impede wireless spectrum today.

Wireless spectrum consists of the invisible radio waves that transmit wireless communications. Wireless spectrum is heavily regulated by governments around the world. Unlicensed spectrum, particularly useful for short distances for such applications as WiFi and BlueTooth, is accessible to any user but still regulated. Licensed spectrum, particularly useful for longer distance communications such as with cellular architectures or satellite, is heavily regulated.

The structure of the regulation of wireless spectrum is distinctly national. Each country has its own set of spectrum regulations, and spectrum regulation in the United States has tended to be similar to that of most other countries. But, as will be described in more detail below, regulation including spectrum regulation in the United States still slowed the development of new wireless services. The wonder is not that the wireless world developed; the wonder is that it developed despite substantial government interference. Federal spectrum regulation still impedes the development of more efficient spectrum markets that could lead to new innovations in wireless markets, transactions, products, and services.

Although markets for wireless devices and services are often global in scope, and the benefits of product and service innovation inure to the benefit of all consumers worldwide, the benefits of improvements in American regulation and improvements in the flexibility of spectrum markets would accrue primarily to the benefit of American consumers.

The challenge for our government today is not to engage in a form of industrial policy to favor the wireless world at the expense of other industries; the challenge is to have the government liberalize the regulation of wireless spectrum and thereby stop impeding the development of the wireless world. Such a step on its own won't cure all of the ills of the larger world. But it should lead to more innovation in the wireless sector and consequently more prosperous American economic activity.

The economic value of a more economically rational approach to spectrum for the wireless world is substantial. Just one year of the economic advantages of spectrum flexibility is worth an order of magnitude more than entire auction receipts for broadcast spectrum, an auction which would not likely take place for years.⁵ But the economic advantages of spectrum flexibility, unlike a spectrum auction, are not one-time events. They are repeated year after year, and over a ten year period, the advantages of spectrum flexibility are likely orders of magnitude greater than a spectrum auction by itself. Spectrum flexibility can help awaken America to the possibility of a new wireless world built on new and unimagined innovation. The federal government could take many steps in that direction. Perhaps the most important is to allow resources to flow to their highest valued uses.

Economic activity flourishes when resources are allowed to seek their highest-valued use

In an efficient economy, resources are not permanently allocated for one purpose. At various times, much of Manhattan was farmland, most of publicly traded securities were in the rail industry, and millions of

Americans were employed primarily as typists. As technology and market conditions change, American resources are reallocated accordingly. If America were locked into the decisions of the past, we would be a much poorer country. The economic growth and innovativeness of America, and every other country in the world, depend on the ability of individuals to pursue more attractive jobs and of businesses to reallocate resources in response to changed circumstances. The more easily America can react to changes in economic conditions, the more rapidly America grows.

Similarly, in an efficient economy, assets can be bought and sold. Thus, individuals and entities pay for the privilege of putting a resource to use. If an asset can be put to a higher-valued use, someone may purchase the asset and put it to that higher-valued use. In an efficient economy, assets are frequently bought and sold, constantly moving them to higher-valued uses.

Practically all major resources in America can and do react to changes in economic conditions. Bushels of wheat go to mills that are willing to pay for them. Investment capital goes to investments that offer the highest returns. High school athletes go to colleges that recruit them. Homes are sold to those willing to pay for them. Seemingly worthless particles of plastic, silicon, and other materials are combined to form highly valued smart phones. And land in Manhattan is no longer primarily used for farming. Matching assets with those who value them is how markets work. It is how America works.

The matching of resources with their highest valued use does not come about by government allocations or technological standard setting. The New York government in neither the 17th nor the 18th century permanently allocated Manhattan land for agriculture. Nor did standards-setting bodies decree that certain agricultural technology be forever used in Manhattan.

Spectrum does not easily flow to its highest valued use because usage is restricted

In the United States, there is one major exception of markets matching resources to those who value them most: wireless spectrum. Allocations of wireless spectrum are difficult to change because the government, not the market, makes most allocation decisions.

In the 1910s and 1920s the federal government asserted ownership over wireless spectrum and has subsequently been licensing and regulating its use.⁶ Although lawyers⁷ and economists⁸ have long noted that markets could more efficiently manage the allocation and assignment of spectrum, the FCC has persisted until today in detailed control over how spectrum is allocated and used.

Since its founding 80 years ago, the FCC has allocated bands spectrum for specific purposes. Thus certain bands were allocated for such purposes as “maritime radionavigation,” “aeronautical radionavigation,” “amateur” purposes, “radio astronomy,” and so on. Some spectrum is assigned to the federal government; other spectrum is assigned to licensees for specific commercial uses. Most spectrum has multiple users occupying the same band with variations on primary and secondary rights to the spectrum.

Because the federal government controls spectrum, allocations for a specific purpose are typically nationwide. Residents in one community cannot simply decide to allocate more spectrum for amateur purposes and less for radio astronomy. The FCC reserves those allocations to itself and makes them on a nationwide basis.

Once the FCC allocates spectrum for a specific purpose, it rarely changes the allocation. Reallocation proceedings can take years to complete. The spectrum for broadcast radio was allocated in the 1920s, and the spectrum for broadcast television today was allocated in the 1940s.

Far more difficult is shifting spectrum from one purpose to another or placing it in a complicated transaction or novel use. If the owner of a broadcast television license wants to use spectrum for a purpose different from its current allocation, she must apply to the FCC for permission, and then wait

months and even years for approval, if it ever is approved. And if the licensee wants to use the spectrum exclusively for a purpose other than broadcasting, she will discover that the FCC won't let her. If America approached land use in the same way that the FCC approaches use of the broadcast spectrum, Manhattan would still be farmland.

Spectrum allocations may change once every few decades after lengthy public proceedings. Over the past 20 years, the FCC has reallocated many blocks of spectrum for various commercial mobile uses, but such uses are still prohibited in the vast majority of spectrum. All spectrum is allocated by the federal government, and most spectrum labors under restrictive rules for its usage.

Not only does the FCC regulate the specific use of spectrum, it often regulates the specific technology or technological characteristics for that use. For example, the specific transmission technologies for television broadcasting are regulated by the FCC; broadcasters may not use different technologies. Even spectrum bands mobile services often have limits on power levels and even architectures for cellular systems.

Although spectrum flexibility is often described as zoning spectrum, federal regulation of spectrum tends to be far more restrictive than local zoning of land use. Of course, associations of private property owners as well as local governments can and do create zones for land usage. Some zones are for residential housing, others are for industrial use, and so on. But real estate zoning is different from federal allocation of spectrum for at least the following reasons:

- Zoning pertains to property unambiguously owned by an individual or other entity, while federal allocation of spectrum pertains to an asset for which the federal government claims ownership, and whose usage is merely licensed.
- Zoning is local rather than national, while federal spectrum allocation is national. Unlike federal allocation of spectrum, local zoning rules change, not infrequently, in a manner typically to improve land value.
- Property owners may petition local officials to have an exception to a zoning rule, and reviews of such petitions are usually conducted—and often granted—in a matter of weeks. FCC licensees can petition the FCC for waivers to spectrum allocation, but these waiver petitions often take more than a year,⁹ and are not necessarily permanent.
- Real estate in the United States is partitioned into millions of parcels allocated by a vibrant market; individuals seeking to purchase real estate zoned for a particular purpose in a particular location may do so.

Spectrum does not easily flow to its highest valued use because transactions are limited

The federal government also reviews and limits spectrum license transfers. Eager sellers of spectrum may find willing buyers, but standing between them is a government that usually delays, often discourages, and sometimes even prohibits simple market transactions. The government prohibits many transactions and uses of spectrum, or imposes costs that effectively prohibit transactions or uses.¹⁰ Often these transactions are not even particularly complicated, and simply involve one entity seeking to continue to use a license for the same purpose.¹¹

Despite the FCC regulation of all license transfers, progress has been made. With each passing decade, license transfers are easier and more predictable. As technology has advanced, more spectrum has been made available for commercial uses. The wireless, satellite, and cable industries developed in part because the FCC made spectrum available to them. As a result of the Omnibus Budget Reconciliation Act of 1993, the FCC received authority to auction spectrum licenses as a means of assigning licenses.¹² The Balanced Budget Act of 1997 gave specific authority for the FCC to auction broadcast licenses.¹³

Today, the FCC has all of the legal authority that it needs to conduct almost any form of spectrum policy. Where the FCC has relaxed regulation of transactions for spectrum, problems have not ensued. It turns out that FCC detailed regulation of transactions is neither necessary nor beneficial.

Despite success with modest efforts as deregulation, the FCC adheres to a centralized planning model for spectrum allocation and license assignments. The model has evolved, but not fundamentally changed, over the past 80 years. One of the primary rationalizations for continuing this policy is supposed problems of interference.

Interference concerns do not require close regulation nor preclude property rights and markets in spectrum

Aside from defending the institutions that have mastered the preexisting method of allocating spectrum, perhaps the superficially strongest political argument against market mechanisms for spectrum are concerns with respect to *interference*. Surely, or so the argument goes, unconstrained market mechanisms will lead to rampant interference among spectrum users, and only stringent regulation can prevent such interference.

The argument, however, fails.

Interference is common with spectrum, even with command-and-control regulation. Interference disputes are resolved often between private parties as a result of their mutual interest rather than the result of regulatory mechanisms. For example, broadcasters sometimes adjust the placement of transmitters on towers to accommodate the signals of other broadcasters. When interference disputes are left to regulatory procedures for resolution, it is often elusive. For example, the FCC failed to resolve interference disputes involving mobile satellite spectrum,¹⁴ WCS,¹⁵ and 900 mhz spectrum.¹⁶

Interference disputes can and will develop, but those disputes can be resolved either directly through the parties or through existing or new legal instruments. Disputes surrounding conflicting property right claims are not unique to spectrum. Such disputes involve practically all forms of property from real estate to intellectual property.

New technologies often lead to new forms of property such as new forms of physical plant and equipment including railroads in the 19th century and various forms of intellectual property today. These and other forms of new property sometimes require new legal concepts to assign rights and to resolve disputes. Historically, new technologies and new forms of property have remained in the private sector. Almost uniquely among property created by new innovations, spectrum rights have been subsumed by governments. This outcome is not necessary.

American consumers have been harmed by the misallocation of spectrum

Government control of spectrum has not led to efficient market allocations and assignments. Willing buyers and sellers flock to the United States for transactions of practically any resource, skill, or security, but not for spectrum.

The costs of poor allocation of spectrum are substantial. Estimates in 2008 of the lost consumer surplus associated with misallocation of certain bands of broadcast spectrum alone were in the hundreds of billions of dollars annually.¹⁷ The lost consumer surplus today is likely substantially greater. The net present value of the value of lost consumer surplus over many years exceeds \$1 trillion.

The history of federal regulation depriving Americans of the benefits of services based on spectrum is not a pleasant one. Between the 1950s and the 1980s, the Federal Communications Commission delayed or blocked applications for new wireless services and development of wireless spectrum as well as new

services such as cable. The lost value of just the undeveloped wireless services to the American economy during this period is difficult to calculate, but twenty years ago, was estimated at more than \$80 billion.¹⁸ The FCC delayed many other services as well.¹⁹

The value to the American economy today of allocating spectrum efficiently is enormous. The lost consumer value can be placed in two categories. One is the economic value for *existing* technologies, *existing* businesses, and *existing* services from a misallocation of spectrum. Most measurements of lost value from poor spectrum allocation focus on the static market at a point in time, and these measurements are in the hundreds of billions of dollars annually.

Innovation is the other loss from poor allocation of spectrum. Each day with bad allocations of spectrum, we lose the economic value of *future* technologies, current and *future* businesses that could use those technologies, and *future* services based on those technologies. The importance of spectrum to innovation has been described by the FCC.²⁰ No good estimates of the innovation losses from poor allocation of spectrum are available, but it could easily be greater than the static market losses from spectrum misallocation. Lost innovation from poor allocation of spectrum can be divided into at least three groups:

- *Lost spectrum market innovations* – Spectrum markets in the United States are remarkably simple and lacking in a wide range of subtle and nuanced options available in many competitive markets. If a business wants to lease a warehouse, or an office, or a parcel of land in almost any community in America, a vibrant market is available to meet that demand on negotiable terms and conditions. If the same business wants to lease one Mhz of spectrum in the same community at a certain time, a spectrum market is rarely available. The very structure of the spectrum markets facing wireless service providers could evolve substantially with better allocation. For example, real-time spot and contract markets could develop for wide swaths of spectrum, or narrow niches of spectrum that vary by geography, time, and frequency.
- *Lost spectrum transactions innovations* – More innovative markets for spectrum might also attract more innovative spectrum transactions. Spectrum transactions in the United States are often slow and cumbersome, impeded by the costs and delays of FCC transaction reviews. Although the FCC has promoted “secondary market” transactions, the use of these transactions has been limited in part because of high transaction costs. An owner of an office building, for example, can use her own office space, or she can lease or sell some or all of the office space on any imaginable terms and conditions. With less regulated allocations of spectrum, transactions should be correspondingly easier as well. Broadcasters, for example, might lease parts of their spectrum during various day parts, or combine transmissions in one six-Mhz channel while leasing other channels.
- *Lost product and service innovation for wireless services* – Fewer product and service innovations develop when spectrum is poorly allocated. With better spectrum allocation, new innovative products and services should be possible. All wireless products and services depend on spectrum; allowing more and competitive spectrum markets to develop should lead to more innovation in wireless products and services. Because spectrum regulation follows national boundaries, and because the United States is in a position to substantially improve its spectrum allocation, America could become the test bed for product and service innovations with flexibly allocated spectrum.

It is difficult to apply a specific economic value to each of these sources innovation. Each type of innovation has substantial value, and they each enhance the value of other types of innovation.

The wireless industry has been a source of substantial growth and innovation for the American economy

Once regulators allowed the wireless industry to develop, it galloped ahead growing much faster than the remainder of the economy.²¹ Devices that we take for granted—lap tops, smart phones, and tablets, to name a few—did not exist 20 years ago, and would not exist in their current form had spectrum not been made available. Innovations surrounding these and other product have created entire industries unimaginable just a few years ago.

Not all spectrum is equally useful for all applications. Spectrum below 3 Ghz has the characteristics for current and anticipated mobile cellular applications such as mobile broadband. Yet the majority of spectrum below 3Ghz is not available for mobile cellular applications. Some of the spectrum is allocated for federal purposes such as defense radars and navigation systems. Some of the spectrum is splintered with a variety of users. The biggest block of underutilized spectrum below 3 Ghz is the broadcast television band with approximately 300 Mhz. Although the broadcast industry uses this spectrum profitably, it would in many instances be even more profitably used for other purposes such as mobile broadband services.

In the 1980s when commercial wireless mobile services were first widely offered, the technology was new and unfamiliar. Prices were relatively high limiting the market to business users and the well-healed. Wireless services initially were available in limited markets in the United States, Western Europe, Japan, and a few other countries.

Much of the innovation in developing wireless technologies, network equipment, and handsets in the decades leading up to the 1980s was conducted in the United States, Europe, and Japan.²² As recently as 2000, most of the manufacturing for wireless technology and most wireless customers were located in the same areas.

American firms still have a major, even disproportionate, role in the global wireless markets. From network equipment manufacturers (e.g., Cisco, Qualcomm) to handset manufacturers (Apple) to wireless software (e.g., Apple, Google, and Microsoft) to online wireless services (e.g., Google, Amazon, Facebook, Twitter) American companies still play a major role in wireless innovation.

But many of the previous natural advantages for wireless technological innovation in the United States are gone. Markets for wireless technologies are international. From handsets to network equipment, manufacturers sell to global markets. Wireless software engineers and applications developers also sell to a global market. While many wireless engineers remain in the United States, many more are abroad, particularly in Asia. The vast majority of wireless equipment manufacturing, even by American companies, is abroad, and the value of communications equipment manufacturing in the United States peaked in 1997 and gradually declined since.²³ Wireless usage is now nearly globally ubiquitous, following population patterns. By some measures, the most advanced wireless networks and wireless services are based abroad.

Increasing Demand and an Inflexible Supply of Spectrum in the United States

The demand for spectrum for mobile broadband purposes has been growing dramatically in recent years. The FCC noted it in the National Broadband Plan.²⁴ Several transactions in the wireless industry in recent years have been premised on rationalizing spectrum holdings to meet increasing demand for spectrum. Many wireless companies would eagerly purchase more spectrum, if it were available for sale.

The mismatch between the expanding demand and the static supply of spectrum in the United States has given rise to popular terms in the trade and popular press such as “spectrum scarcity” and “spectrum shortage.”²⁵ Most introductory students of economics learn that “shortage” and “scarcity” usually are the

artifacts of unnatural supply disruptions or artificial price controls. In a market in which sellers can freely sell to buyers and in which prices are not regulated, prices will clear markets such that demand equals supply without “shortages” or “scarcity.” Where those terms are commonly and persistently used, markets are not working well. The popularity of the terms “spectrum scarcity” and “spectrum shortage” reveals the shortcomings of spectrum markets in the United States.

Practically all bands of spectrum in the United States suffer from poor allocation. Even where technology would permit different uses of spectrum, government rules delay and discourage new uses for spectrum. While many other bands are no more efficiently allocated, much of the public attention on spectrum misallocation has focused on broadcast television. Partly, that is because the broadcast television band is large and has substantial market value. Partly, that is also because many broadcast licensees would be willing to sell their licenses for other purposes.

Congress and the President have noticed the importance of broadcast spectrum

Congress has attempted to address the allocation of broadcast spectrum. Congress passed, and President Obama signed in early 2012, a law that, among other things, will require the FCC by 2022 to do the following:²⁶

- conduct a reverse auction to determine the amount of compensation that each broadcast television licensee would accept in return for voluntarily relinquishing some or all of its broadcast television spectrum usage rights;²⁷
- reallocate such portions of such spectrum as the Commission determines are available for reallocation;²⁸ and
- Conduct a forward auction in which the Commission assigns licenses for the use of the spectrum that the Commission reallocates.²⁹

Although the statute does not specify the purpose of the reallocation of some portion of television broadcast band, it is widely assumed to be mobile broadband services. By statute, the FCC auctions only be completed by fiscal year 2022.³⁰ Actual commencement of new wireless broadband services would likely be further years after the auctions.

The purposes of the broadcast television spectrum auctions are generally recognized as the following:

- Reallocate some portion of the broadcast television spectrum for mobile broadband services while compensating those incumbent broadcasters who would vacate their licenses through a reverse auction;³¹
- Generate sufficient auction revenue to pay for the reverse auction and the compensation of broadcasters;³²
- Generate \$7 billion of further auction revenue for public safety purposes;³³ and
- Generate additional auction revenue for deficit reduction.³⁴

The FCC has assigned itself the role of exclusive real estate agent for broadcast spectrum and proposed complicated and likely unworkable rules

The statutory language authorizing the FCC auctions for the broadcast spectrum easily fits on six pages.³⁵ It does not require complicated auctions or complicated rules. The FCC could have lawfully proposed simple rules for simple auctions.

Instead, the FCC has proposed rules for an extraordinarily complicated set of auctions in a 205-page document.³⁶ Final rules will not likely be issued soon, and the auctions required by law are years away.

The approach proposed by the FCC has many problems. These problems mostly stem from the structure of the FCC establishing itself as the exclusive real estate agent for both buyers and sellers of broadcast licenses. No one can repurpose broadcast licenses without selling them to the FCC, and no one can purchase rights to spectrum previously assigned as broadcast licenses without purchasing those rights through the FCC. In no other market does the federal government—or anyone else—place itself in the exclusive role of market maker and real estate agent for all parties on all sides of every transaction between private sellers and private buyers. In the history of commerce, such a role for a party, either private or governmental, has no specific precedent. The absence of a precedent is a strong signal that such a governmental role likely will not work.

The specific problems with the proposed FCC rules include the following:

- The FCC's proposed auction structure is unnecessarily complex. Under these circumstances, potential buyers and sellers have difficulties making plans for the auctions. The statute permits, but does not require complexity.
- Even if the proposed auction process were not unnecessarily complex, it is unnecessarily time-delaying. It will take many years, perhaps 10 or more, to complete the auction and reallocation process. The statute permits, but does not require time delays.
- Even if the proposed auction process were not unnecessarily complex or time-delaying, it is a bad structure for *all* potential sellers of spectrum. It denies sellers from selling their spectrum *today* to willing buyers who would put the spectrum to a non-broadcast purpose. Those potential sellers must instead wait years for the FCC to complete its rules and implement an auction and clear the spectrum after the auction.
- Even if the proposed auction process were not unnecessarily complex or time-delaying, and even if it were not a bad structure for *all* potential sellers of spectrum, it is a bad structure for potential willing sellers who will not be able to sell their spectrum under it. The proposed FCC auction structure condemns the vast majority of broadcasters to no alternative future but television broadcasting. Only broadcast licensees in DMAs where the FCC would conduct a reverse auction will actually have an opportunity to participate in a reverse auction. Under many scenarios, most DMAs have enough dark licenses to conduct a forward auction without a reverse auction. Broadcasters in these markets without a reverse auction who would nonetheless prefer to cease broadcasting in return for compensation will not be able to do so. Even in those markets with reverse auctions, broadcasters who are unsuccessful in the reverse auction but who would nonetheless prefer to cease broadcasting in return for compensation will not be able to do so.
- Moreover, the FCC proposal provides no path to selling spectrum for broadcasters who today wish to continue broadcasting, but who ten years from now, soon after the auction, may decide they would prefer to sell or use their spectrum for another purpose. The proposed rules contemplate a single auction. Those broadcast licensees who miss the auction have no specific subsequent recourse.
- Even if the proposed auction process were not unnecessarily complex or time-delaying, and even if it were not a bad structure for *any* potential sellers of spectrum, it is a bad structure for *all* potential buyers of spectrum. Many of those potential buyers would be willing to buy spectrum today, but under the proposed rules will not be able *today* to purchase spectrum from willing sellers. Those potential buyers must instead wait years for the FCC to complete its rules and implement an auction and clear the spectrum after the auction.
- Even if the proposed auction process were not unnecessarily complex or time-delaying, and even if it were not a bad structure for *any* potential sellers of spectrum, and even if it were not a bad structure for *all* potential buyers of spectrum, it would still be a bad structure for some potential buyers of spectrum. Those potential buyers of spectrum will wait for years and go to auction, and by definition of an auction, some of those potential buyers will be unsuccessful in the auction. They will bid less than the successful bidders, but even some of the lower bids may still be

greater than the price at which some broadcast licensees would be willing to sell their spectrum but were unable to do so in the auction.

- Moreover, the FCC proposal provides no path to buying spectrum for potential buyers of spectrum who today may place a low value on buying spectrum or participating in the auction, but who ten years from now, soon after the auction, may decide they would prefer buy spectrum even at a price higher than that obtained in the auction. The proposed rules contemplate a single auction. Those potential buyers who miss the auction have no specific subsequent recourse.
- Even if the above conditions did not hold, placing a federal agency as the exclusive middleman in an exchange of an asset between one private party and another private party is fraught with peril. It is a transaction structure with no common precedent, and the FCC proposes complicated auction methods that may ultimately prove unsuccessful.
- Even if the auction processes work, the situation of the government standing between two private parties in an exchange raises issue similar to *Kelo*.³⁷

It is possible, given enough time and effort, and under fortuitous circumstances, that the FCC's proposal could eventually lead to an allocation of spectrum that better reflects market sensibilities than the current allocation. But writing the rules and conducting the auction and enforcing the results would take years. The outcome is far from certain. There is a much better solution.

The FCC should adopt a simpler, more efficient solution: allow spectrum to be used flexibly

Consistent with law, the FCC should adopt a more market-based approach to spectrum management. I call it "Spectrum Flexibility." Aside from extending the FCC's auction authority, no Congressional action was even needed. Yet the FCC can still allow spectrum flexibility under the new law. Here are the steps for the better approach:

Allow flexibility for most spectrum including broadcast spectrum. The FCC allocates spectrum for specific uses in specific bands. Under Commission rules, licensees in bands allocated for satellite services must offer satellites services, and licensees in the television broadcast spectrum must engage in broadcasting television. Why the rigidity? In recent years, the FCC has increasingly granted greater flexibility of use to licensees. For example, the FCC has granted flexibility to mobile satellite service providers to use spectrum for some terrestrial purposes.³⁸ The presumption should be that spectrum can be used for any purpose as long it does not interfere with neighboring licensees. The allocation of spectrum is primarily by rule rather than statute, and the licensing rigidities that do not permit licensees to offer other services is entirely a regulatory construct. The Commission has the authority to grant flexibility in practically any band. It has chosen to exercise that authority in some, but not all bands. It could use that authority more completely.

- *Under spectrum flexibility, broadcasters and other licensees could offer other services, or sell part or all of their licenses to other entities to offer other services* These transactions could happen as soon as the FCC wrote rules to allow for flexible use of spectrum, likely years before the FCC could conduct an auction. Broadcasters in every market, not just those selected by the FCC for a reverse auction, could sell their spectrum. Any licensee who wanted to sell their spectrum could do so; no licensee would be left behind.
- *Conduct the forward auction for the dark licenses.* Most of the geography and spectrum in the broadcast band is not directly occupied by full-power broadcast licensees. Consistent with the statute, the FCC would still conduct the forward auction for the unused and dark licenses. Such an auction would raise substantial sums of money, quite likely more than the \$7 billion guaranteed for public safety. But the auction would not need to wait for the return of broadcast licenses. It would be a simple auction subject to FCC rules. The simpler forward auction could likely be conducted sooner than the FCC's proposed auction. There are many options for the forward

auction. One option would be based on an overlay model.³⁹ A different option would preserve multiple buyers for broadcast licenses and repackage remaining broadcasters into contiguous channels once every two years.

- *Conduct the reverse auction.* Most licensees will get a larger payment and sooner by selling their spectrum in a competitive market rather than the reverse auction. But, as required by statute, after the forward auction, the FCC could still conduct the reverse auction. The statute requires no particular size of a reverse auction, and the FCC could tailor it to those licensees, if any, who only want to sell their spectrum to the federal government. The FCC should oblige them. It would likely be a formality as any licensee that wanted to sell its spectrum could already have done so by a direct transaction with a buyer.

The Spectrum Flexibility proposal is superior to the currently proposed FCC rules for many reasons. Here are just a few.

The Spectrum Flexibility proposal is far simpler than the proposed FCC rules

It would not take five pages, much less 205 pages, to propose rules to allow flexible use of spectrum. There would be no need for complicated and novel auction procedures. Everyone could understand the new rules without requiring an army of lawyers and economists to interpret them.

How much does America value simpler rules? The FCC, as part of compliance with the Regulatory Flexibility Act, should provide an estimate of the administrative cost of compliance. Although the FCC does present a document labeled an “Initial Regulatory Flexibility Act Analysis,”⁴⁰ the FCC does not present any reasonable accounting of expected actual or potential costs.⁴¹ The actual costs are not limited to the administrative costs of businesses that successfully buy or sell spectrum but must hire lawyers and economists to comply with the new rules. The larger and much more troubling costs include the following:

- The administrative costs associated with hiring professional advisers to interpret and comment on the NPRM;
- The administrative costs associated with participating in the various proposed auctions for both buyers and sellers;
- The opportunity costs for the countless businesses and individuals that, upon reviewing the complex rules, despair of even trying to participate;
- The opportunity costs of time for both buyers and sellers for the inherent delays between the publishing of the NPRM and the ultimate date when licenses might be transferred and licensees paid;
- The opportunity costs of forgone innovation that will not be recognized during the years when more spectrum is not made available to the market;
- The opportunity costs of forgone economic activity for the American economy during the years when more spectrum is not made available to the market;
- The opportunity costs of forgone competition from new businesses that will not develop without new spectrum; and
- The disproportionate concentration of the above costs on small entities.

The Spectrum Flexibility proposal gets more spectrum in the market

The spectrum flexibility proposal would almost certainly lead to more spectrum in the commercial market for a few reasons. First, license-holders outside of the broadcast band would have an opportunity for flexibility, leading to more potential spectrum for commercial applications. Flexibility animated the decisions to grant ancillary terrestrial component to mobile satellite service providers. In contrast, under the FCC proposal, only licenses within the broadcast band that would be successful in a reverse auction

would be affected. Under the FCC's proposal, thousands of licensees, both inside and outside the broadcast band, would not be granted flexibility.

No one knows exactly how much spectrum the FCC plans to make available under its auction proposals. Estimates range from 90 Mhz – 120 Mhz nationwide, all decided by the government. Under the spectrum flexibility approach, the market rather than Washington would decide how much additional spectrum would be made available for mobile applications. It might be more than 120 Mhz in some markets and less in others. It might vary by time of day, geography, and frequency, but it would ultimately be a market outcome determined by the willingness of people to pay for the additional spectrum.

Second, under the spectrum flexibility proposal, within the broadcast band, every broadcaster, regardless of DMA would have an opportunity to develop or to sell some or all of her spectrum for commercial development. Under the FCC proposal, only broadcast licensees in DMAs that would have reverse auctions would have any opportunity to sell their licenses, and not every broadcaster would be successful in selling their licenses in the auction. Under the FCC proposal, many broadcast licensees who would be interested in selling some or all of their spectrum will be unsuccessful in doing so because of FCC decisions. Under spectrum flexibility, no broadcast licensee interested in selling spectrum is prohibited from doing so.

How much does America value getting more spectrum in the market? Economists have estimated the market value of the broadcast spectrum put to other uses at more than \$100 billion annually. Current FCC rules capture none of this value. The FCC proposal would shift only part of the broadcast band to other purpose. The spectrum flexibility proposal would potentially shift much more spectrum, both inside and outside the broadcast band, to other purposes.

The Spectrum Flexibility proposal gets spectrum in the market sooner

One of the more startling provisions in the spectrum statute is that the broadcast spectrum auctions must be completed only by the end of fiscal year 2022.⁴² The statute contains no deadline on putting spectrum to commercial use, presumably well after the auctions are completed. For most individuals and businesses, ten years or more is a long time, practically an eternity. America can do better, much better.

Removing zoning restrictions and providing more flexibility can be done quickly. As soon as the zoning restrictions on spectrum were removed, broadcast and other spectrum could be put to different uses. Of course, within the broadcast band, care must be taken to avoid interference between broadcasters and other purposes. But avoiding interference is the norm rather than the exception in the wireless industry. The FCC could facilitate that process by repackaging broadcasters in adjacent bands as some licenses are put to other uses. Some observers note that no specific government action is necessary with an overlay as market forces will take care of most if not all interference issues.⁴³

How much sooner than auctions will rezoning get spectrum to the commercial market? It is difficult to say exactly how much sooner, but the FCC could allow spectrum flexibility within a year, and an auction is still several years away, at least. Moreover, under the Spectrum Flexibility proposal, allowing more spectrum to come to market is not a one-time event such as an auction. Instead, spectrum licensees can react at any time, either before or after a proposed auction, to bring competitively effective spectrum to market.

How much does America value getting spectrum to the market sooner? It is difficult to calculate a precise measure, but it is in the range of hundreds of billions of dollars annually. Current FCC rules capture none of this value, and the FCC proposed rules will take several more years to take effect.

The Spectrum Flexibility proposal yields a competitive price for spectrum

As noted above, the current markets for spectrum in the United States are frequently characterized with the terms “scarcity” or “shortage.” The reason is not price regulation but instead reflects supply disruptions or regulatory impediments to supply. Prices to potential users of spectrum today are likely higher than those that would obtain in a competitive market in which spectrum licensees could easily make spectrum available in response to demand changes. The higher prices are caused both by artificially preventing much spectrum from becoming available to users, and, even when spectrum is made available for use, the unusually high transactions costs associated with making it available.

Because the Spectrum Flexibility Proposal would allow licensees to make spectrum freely available in spectrum markets, not only would more spectrum come to market more expeditiously than under the current regulatory system or the FCC’s proposal, but the resulting price of spectrum would be close to the competitive price.

How much does America value getting spectrum to the market at a competitive price? It is difficult to measure, but the producer and consumer surpluses associated with lower spectrum prices are substantial. Current FCC rules capture none of this value, and the FCC proposed rules would capture little of it as well.

The Spectrum Flexibility proposal avoids exclusive buyers and exclusive sellers and the exclusive real estate agent problem

Americans like to sell and shop in competitive markets. No one would prefer to shop in a town with only one grocery store, or buy and sell in a community with only one car dealership, or buy and sell a house in a community with only one real estate broker. Yet the FCC’s auction proposal is exactly that: the equivalent of a real estate market with only one agent serving all seller and buyers. No one knows exactly whose interest such a real estate broker would represent except its own.

Reasonable consumers and businesses don’t like markets where there is only one supplier. A single supplier in a market is a monopolist, and, under its broadcast auction proposal, the FCC in its forward auction proposal is setting itself up to be a monopoly supplier of new spectrum in the commercial market. Under the FCC’s forward auction, only the terms and conditions offered by the FCC would be available to potential buyers. Under the FCC proposal, current licensees, particularly broadcast licensees, are not allowed to use spectrum for other purposes or sell it to others for development in competition with the FCC’s exclusive selling arrangement.

In contrast, under the Spectrum Flexibility plan, multiple sellers in a market would compete with one another to provide a product at lower prices and higher quality. Multiple sellers would also compete on timing, terms and conditions of transactions.

In a similar manner, the FCC in its reverse auction proposal is setting itself up as the exclusive buyer of spectrum for non-broadcast purposes. Dozens of other entities may be interested in purchasing spectrum for non-broadcast purposes, but they will not be allowed to compete with the FCC to purchase spectrum directly from licensees. Multiple buyers in a market will compete with one another to purchase a product at higher prices and higher quality. The FCC’s reverse auction plan allows for no other direct buyers. Multiple buyers will also compete on timing, terms and conditions of transactions. The FCC’s reverse auction plan allows for no other buyers, and potential sellers must accept the timing, terms and conditions offered by the only buyer in the market, the FCC.

Under the Spectrum Flexibility plan, anyone may purchase licenses directly from broadcast licensees. These multiple buyers in the market would compete for terms and conditions of transactions.

Not only does the FCC set itself up in one auction as the sole buyer and in another auction as the sole seller, the FCC places itself as the exclusive transaction agent between one set of private sellers and another set of private buyers. There is substantial precedent for the government to purchase private assets for a public use under the doctrine of eminent domain, but that is not the purpose of the FCC proposal. And there is a substantial precedent for the government to use auctions to transfer an asset such as a government security or a grazing right from the public sector to a private user. That is not the exclusive purpose of the FCC proposal. But there is no good precedent for the government to place itself in between willing private sellers and willing private buyers. That ultimately is the primary purpose of the combination of the reverse auction and the forward auction as proposed by the FCC. The potentially corrupt outcomes from such a situation were widely discussed in the public comments surrounding *Kelo*.⁴⁴ All of these potentially bad outcomes are avoidable by the FCC.

How much does America value avoiding single buyers and single sellers? It is difficult to estimate an exact value for having competitive buyers and sellers in a market, but it is substantial.

The Spectrum Flexibility proposal gets the government out of micromanaging markets

Even if the FCC proposal were simple and were capable of getting more spectrum to market sooner without relying on placing itself as the exclusive buyer and seller of spectrum—none of which conditions hold, the FCC proposal still relies on extraordinary government intervention and micromanagement of spectrum markets. The Spectrum Flexibility proposal does not.

How much does America value avoiding government micromanagement of spectrum markets? It is difficult to estimate an exact value, but it is substantial.

The Spectrum Flexibility proposal allows for greater innovation in spectrum markets and spectrum transactions

In a static view of spectrum markets, additional spectrum brought to market sooner could be worth hundreds of billions of dollars annually. But many markets are driven by technology, and wireless markets, perhaps more than almost any other market, follow rapid technological changes.

Spectrum flexibility would facilitate innovation in the structure of spectrum markets. It is impossible to describe what wireless markets in America would look like with substantially more spectrum, both vast swaths of contiguous spectrum as well as small bits of spectrum divided by geography, time, or frequency. Spectrum would flow to its highest valued use, and businesses with new and innovative business models would be willing to pay for more spectrum.

Spectrum flexibility would also facilitate novel and innovative transactions for spectrum. Small businesses and even government agencies will see value in making their spectrum available in the more flexible spectrum markets of the proposal. For example, spectrum flexibility might enable contracts for spectrum that would make spectrum available contingent on certain market conditions being met in a real-time spectrum exchange market. Neither the real-time spectrum exchange nor sophisticated contracts for spectrum on the exchange exist today. Spectrum flexibility and more efficient allocation of spectrum allow for all of this.

Over the past few decades, much of the innovation that has enhanced the lives of Americans and propelled the competitiveness of American businesses has been associated with various forms of new wireless technology. From scanning devices to cell phones, from GPS to the wireless internet, wireless innovation marches on. There are no good estimates of the value of wireless spectrum with rapidly changing technology.

Making spectrum available in flexible markets can only facilitate wireless product and service innovation. Businesses will be able employ spectrum in ways not possible today. Today, America allocates spectrum and has spectrum rights that are little different and no better than spectrum allocation in many other countries. Under the Spectrum Flexibility plan, America will have the most flexible and innovative spectrum allocation in the world. Engineers and entrepreneurs will flock to America to use our flexible spectrum as the test bed for new services, services that can only be imagined in an America with flexible use of spectrum.

How much does America value innovation in spectrum markets? It is difficult to estimate an exact value, but it is substantial.

Conclusion

Table 1 presents a summary of the advantages of spectrum flexibility relative to the FCC's recent proposal for a broadcast spectrum auction. Many different criteria are listed in the table, and for each criterion the spectrum flexibility proposal has advantages relative to the FCC's proposal broadcast auction rules. The spectrum flexibility proposal offers far greater opportunities for spectrum market innovation, spectrum transaction innovation, and wireless product and service innovation than either the current FCC rules or the proposed broadcast auction rules. The economic value of a more economically rational approach to spectrum for the wireless world is difficult to quantify but is substantially greater than those associated just with the auction receipts of a broadcast spectrum auction, which have been estimate by CBO at \$15 billion over ten years.⁴⁵

Table 1**Summary of the advantages of flexible spectrum option**

	Current rules combined with FCC proposal	Spectrum flexibility proposal
Complexity of rules for spectrum use	Complex	Simple
Complexity of rules for new spectrum auctions	Complex	Simple
Amount of additional spectrum available for new mobile services	Perhaps 90 – 120 Mhz of broadcast band	Almost certainly substantially more spectrum than FCC proposal, both inside and outside broadcast band
Timing for additional mobile spectrum	Years after completion of auctions	As soon as rules are completed
Price of spectrum relative to competitive price	Lower than current system but higher than competitive market	Competitive price once flexibility in place
Owners of spectrum rights make more available to competing uses as price rises	Slightly more response	Fully responsive to prices
FCC as exclusive buyer of spectrum	Yes	No
FCC as exclusive seller of spectrum	Yes	No
FCC micromanages spectrum use	Yes	No
Opportunities for spectrum market innovations	No	Yes
Opportunities for spectrum transaction innovations	No	Yes
Opportunities for spectrum product and service innovations	Some	Most
Increased economic value relative to current system	Once spectrum is put to new use, perhaps a few hundred billion annually of combined consumer and producer surplus	With more spectrum put to use more quickly and fully responsive market conditions, substantially greater consumer and producer surplus both initially and in subsequent years

¹ Senior Fellow, Hudson Institute. I wish to thank Tom Hazlett and Christopher DeMuth for valuable comments on earlier drafts of this paper. The views expressed in this paper are those of the author alone and do not necessarily reflect the views of anyone else.

² Of course, use is not without limit. The economically meaningful limitations on use tend to be related to common law concepts of trespass and nuisance. See, e.g., R. Posner, *Economic Analysis of Law*, Chapters 1 and 2, Little Brown & Company, 1973. Resources that are not put to their highest-valued use have an opportunity cost, or the difference in value between their current use and their highest-valued use.

³ Transactions also have limitations. The possible limitations on transactions include antitrust law. The efficient transactions of property are related to property and contract under common law. See Posner, Part I.

⁴ The consumer surplus generated by additional bandwidth used by the carriers has been found to exceed, on an annual basis, ten times the producers' surplus which in turn is the amount carriers would be willing to bid at auction for spectrum licenses. See, e.g., T.W. Hazlett, "Optimal Abolition of FCC Spectrum Allocation," *Journal of Economic Perspectives*, vol. 23, p.,103 (Winter 2008). T.W. Hazlett and R. E. Muñoz. 2009. "A Welfare Analysis of Spectrum Allocation Policies," *Rand Journal of Economics*, vol. 40, p. 424, Autumn 2009. T.W. Hazlett, "Unleashing the DTV Band: A Proposal for an Overlay Auction," comment submitted to the FCC in GN Docket 09-47, GN Docket 09-51, and GN Docket 09-137, December 18, 2009.

⁵ CBO estimates net auction receipts of approximately \$15 billion over a ten year period ending in fiscal year 2022. See CBO letter from D.W. Elmendorf to D. Camp, February 16, 2012, at http://www.cbo.gov/sites/default/files/cbofiles/attachments/hr3630_2.pdf.

⁶ For a history of the federal assertion of ownership, see T.W. Hazlett, "The Rationality of U.S. Regulation of the of the Broadcast Spectrum," *The Journal of Law and Economics*, vol. 33, No. 1, 1990.

⁷ L. Herzl, "Public Interest and the Market in Color Television Regulation," *University of Chicago Law Review*, vol. 18, 1951.

⁸ R. H. Coase, "The Federal Communications Commission" *Journal of Law and Economics*, vol. 2, 1959. See also various publications of T. Hazlett.

⁹ See FCC Docket 12-70, Service Rules For Advanced Wireless Services in the 2000-2020 Mhz and 2180-2200 MHz Bands.

¹⁰ The substantial economic literature on transactions and related costs has been developed by, among others, R. Coase, A. Alchian, and O. Williamson. T. W. Hazlett has particularly examined the specific application of transaction cost analysis to spectrum regulation in the United States, particularly with respect to broadcast spectrum.

¹¹ The FCC does allow some secondary market transactions in certain bands of spectrum.

¹² Omnibus Budget Reconciliation Act of 1993, Pub. L. No. 103-66.

¹³ Balanced Budget Act of 1997, Pub. L. 105-33.

¹⁴ See FCC Docket 11-109, LightSquared Technical Working Group Report.

¹⁵ See FCC Docket 07-293, In the Matter of Establishment of rules and policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band.

¹⁶ See FCC Docket 06-49, In the Matter of Amendment of the Commission's Part 90 Rules in the 904-909 and 919.75-928 MHz Bands.

¹⁷ The consumer surplus generated by additional bandwidth used by the carriers has been found to exceed, on an annual basis, ten times the producers' surplus which in turn is the amount carriers would be willing to bid at auction for spectrum licenses. See, e.g., T.W. Hazlett, "Optimal Abolition of FCC Spectrum Allocation," *Journal of Economic Perspectives*, vol. 23, p.,103 (Winter 2008). T.W. Hazlett and R. E. Muñoz. 2009. "A Welfare Analysis of Spectrum Allocation Policies," *Rand Journal of Economics*, vol. 40, p. 424, Autumn 2009. T.W. Hazlett, "Unleashing the DTV Band: A Proposal for an Overlay Auction," comment submitted to the FCC in GN Docket 09-47, GN Docket 09-51, and GN Docket 09-137, December 18, 2009.

¹⁸ J. H. Rohlfs, C. L. Jackson, and T. E. Kelly, "Estimate of the Loss to the United States Caused by the FCC's Delay in Licensing Cellular Telecommunications" (National Economic Research Associates, Inc., November 8, 1991, revised).

¹⁹ H. W. Furchtgott-Roth, *A Tough Act to Follow*, AEI Press, 2006, at 24-25.

²⁰ See FCC, *Connecting America: National Broadband Plan*, Chapter 5, 2010, at www.broadband.gov.

²¹ Between 1992 and 2007, the wireless industry and related industries grew much faster than the remainder of the American economy. See H. Furchtgott-Roth, *The Wireless Sector: A Key to Economic Growth in America*, report prepared for CTIA, January 2009.

²² See, e.g., D Mock, *The Qualcomm Equation: How a Fledgling Telecom Company Forged a New Path to Big Profits and Market Dominance*, AMACOM, 2005.

²³ U.S. communications equipment manufacturing had \$82 billion in value of shipments in 1997. See U.S. Census Bureau, 1997 Economic Census, Manufacturing, Table 1-1d, at <http://www.census.gov/prod/ec97/97m31s-gs.pdf>. By 2010, this value had declined to \$47 billion in nominal terms. In real terms, the decline is greater. See http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ASM_2010_31GS101&prodType=table.

²⁴ FCC, *National Broadband Plan*, Chapter 5.

²⁵ The term “spectrum scarcity” yielded 57,700 Google hits, and the term “spectrum shortage” yielded 39,500 hits during a search on November 12, 2012.

²⁶ “Middle Class Tax Relief and Job Creation Bill of 2012,” PL 112-96, <http://www.gpo.gov/fdsys/pkg/PLAW-112publ96/html/PLAW-112publ96.htm>. See particularly Title VI.

²⁷ *Ibid.*, Section 6403(a).

²⁸ *Ibid.*, Section 6403(b).

²⁹ *Ibid.*, Section 6403(c).

³⁰ PL 112-96, Sections 6402, 6405.

³¹ *Ibid.*, Section 6403.

³² *Ibid.*

³³ *Ibid.*, Section 6413.

³⁴ *Ibid.*

³⁵ *Ibid.*, Title VI, subtitle D.

³⁶ FCC 12-118, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, *Notice of Proposed Rulemaking*, adopted September 28, 2012, released October 2, 2012.

³⁷ *Kelo v. City of New London*, 545 U.S. 469 (2005).

³⁸ *Flexibility for Delivery of Communications by Mobile Satellite Service Providers, Memorandum Opinion and Order and Second Order on Reconsideration*, 20 FCC Rcd 4616 (2005).

³⁹ T.W. Hazlett, “Unleashing the DTV Band: A Proposal for an Overlay Auction,” comment submitted to the FCC in GN Docket 09-47, GN Docket 09-51, and GN Docket 09-137, December 18, 2009.

⁴⁰ FCC 12-118, Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, *Notice of Proposed Rulemaking*, adopted September 28, 2012, released October 2, 2012, at Appendix B.

⁴¹ See H. Furchtgott-Roth, Testimony before the U.S. House of Representatives, Judiciary Committee, Subcommittee on Courts, Commercial and Administrative Law, “Cost-Justifying Regulations: Protecting Jobs and the Economy by Presidential and Judicial Review of Cost and Benefits,” May 4, 2011.

⁴² 47 U.S.C. 1452(f)(3).

⁴³ T.W. Hazlett, “Unleashing the DTV Band: A Proposal for an Overlay Auction,” comment submitted to the FCC in GN Docket 09-47, GN Docket 09-51, and GN Docket 09-137, December 18, 2009.

⁴⁴ *Kelo v. City of New London*, 545 U.S. 469 (2005).

⁴⁵ CBO estimates net auction receipts of approximately \$15 billion over a ten year period ending in fiscal year 2022. See CBO letter from D.W. Elmendorf to D. Camp, February 16, 2012, at http://www.cbo.gov/sites/default/files/cbofiles/attachments/hr3630_2.pdf.