

# Identifying Market Power in Times of Constant Change

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*We explain that traditional approaches to defining markets to investigate market power fail in times of constant change because demand and supply are in constant flux. The analyses rely upon historical data, the value of which degrades over time, possibly resulting in harmful regulatory decisions. This points to a need for a different approach to determining when regulation is an appropriate response to market power. We present an approach that relies upon essential factors leading to monopoly (EFMs), such as control of essential facilities, which persist across generations of products. Market power analyses should be a search for EFMs and policy responses should focus on diffusing the market power without destroying value. We use the telecommunications industry to illustrate our approach.*

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The justifications for laws regarding competition policy in general, and for economic regulation of utility services more specifically, have long centered the notion of market power.<sup>1</sup> Traditional economics texts define market power as the ability of a firm to raise price without suffering a significant decline in quantity demanded. (Viscusi, Vernon and Harrington 2000) This definition suffers from the problem that, in equilibrium, a profit maximizing firm with market power could not profitably raise its price. So perhaps a more effective definition of market power would be that the market demand for the product in question and the demand for the firm's product are nearly the same, implying a near identity between the firm and the market. Firms are considered utilities and subjected to economic regulation if they have monopoly power<sup>2</sup> and their services are essential for economic life, meaning that if such firms exploit their monopoly power customers suffer significant economic harm. (Glaeser 1927, Trebing 2001, Jamison and Hauge 2014)

Regulations emanating from concerns over market power include restrictions on single firm conduct – such as exclusive agreements and refusals to deal – limitations on mergers, and utility-style regulation, including controlling retail and wholesale prices, enforcing service quality, and imposing obligations to serve.<sup>3</sup> (Bonbright, Danielsen and Kamerschen 1988; Brock 1981; Federal Trade Commission 2016) Absent these conditions of essentiality and monopoly, and

<sup>1</sup> In some contexts market power may be beneficial to customers. For example, in some circumstances firms with market power have a greater incentive to invest in new technologies than do firms in more competitive markets. (Jamison and Hauge 2011) Platform markets – generally two-sided markets that exhibit network effects – tend to tip, resulting in a monopoly or near monopoly, and the tipping creates customer value. (Rohlfs 1974) Also a single platform can have multiple diverse market interactions, making the platform monopolistic for some customers but not for others.

<sup>2</sup> We define monopoly power as a special case of market power in which the firm's demand and the market demand are the same.

<sup>3</sup> Because it is generally accepted that utility services, such as energy and telecommunications are essential for economic life in advanced and advancing economies, the decision of whether to engage in economic regulation is based largely on beliefs about market power. And because incumbents were, and perhaps still are granted monopoly status by their governments, the traditional practice for considering whether to regulate has been to assume that there is market power absent a specific finding that there is competition. However, the economic regulation of interconnection in telecommunications often remains even if there is competition because there are questions about whether competition can keep interconnection prices at efficient levels. (Laffont, Tirole and Rey 2000; Armstrong 2002)

even with them, government intervention in the marketplace can devolve to rent seeking where the regulations serve the interests of the regulated or the politically powerful rather than the public interest in a well-functioning economy. (Posner 1971, Stigler 1971, Peltzman 1976) Therefore, economic regulation should be used with caution.

One difficult challenge for knowing whether a market is competitive is defining the market. “Market” in this context means a product space (typically defined by product features and geography) within which customers are willing to readily substitute between service providers, but beyond which customers do not find suitable substitute products. This analysis is traditionally accomplished using a hypothetical monopolist test. In this approach market boundaries are discovered by examining whether product substitutability and competitive entry were such that above-normal profits could not be sustained if the market were served by a hypothetical monopolist. (Baker 2007, Jamison and Hauge forthcoming)

The hypothetical monopolist approach has flaws, such as the cellophane fallacy (Stocking and Mueller 1955), but is workable and constitutes best practice in situations where technologies and markets are stable. But recent developments have made this approach ineffective in many situations. In information and communications (ICT) industries, the growing prominence of new technologies, platform markets, and next generation networks have shortened product lives. Also next generation networks enable software apps to replace services traditionally hardwired into voice networks. In electricity the application of distributed energy resources, new metering technologies, and transactional energy have changed traditional definitions of utility services. In such instances identifying market power by traditional means is futile because the methods are dependent on historical data and take time to complete, making the analyses of limited relevance to future decision making.

This paper addresses the dilemma of assessing market power when markets are constantly changing by suggesting that analyses focus on enduring factors creating monopoly (EFMs). A factor is an endowment leading to monopoly if it is needed by all who might want to produce the relevant service and its limited supply causes competition to fail. An example might be a government grant of monopoly. A factor is enduring if it is needed across multiple generations of products, such as control of essential rights of way. We use telecommunications as our sector for discussion, but the analysis could apply industries as well.

The remainder of this article is organized as follows. It first describes the evolution of the telecommunications sector as our case in point. Section 2 examines the traditional approach for identifying market power. Section 3 provides a description of our proposed alternative to the traditional approach. Section 4 applies our framework to a current issue in telecommunications and Section 5 is the conclusion.

## **I. The Telecommunications Sector**

Legacy telecommunications technologies incorporated telephone handsets, local wireline access, manual and then automated switches for connecting callers, and intercity lines that provided international and domestic long distance service. This architecture developed alongside industry structure and government regulatory frameworks that reinforced each other. Industry players were generally state-owned or privately owned telephone companies with monopoly franchises, interconnected across borders through a long distance network owned and operated largely by major operators, such as AT&T. State-owned enterprises were largely unregulated, but governments employed utility-style regulation for monopoly privately owned providers. (Brock 1981, Wellenius and Stern 1994) Networks had value because of the number of customers that could be reached,

with customers providing content through their speaking during calls. (Rohlf's 1974)

It is important to our analysis in Section 4 to note that the legacy technologies and network architectures were specialized and initially specific to the voice services. As technologies advanced, large customers such as businesses and governments began demanding lines capable of handling large amounts of data. Telecommunications companies addressed this need by forming private network services. These services used some of the same physical infrastructure as the voice network, such as telephone poles, buildings and some cables, but the private and public networks were effectively separate. (Brock 1981)

Today telephone sets have been replaced by a wide range of customer devices, including simple cell phones, smartphones, tablets, television sets, personal computers and other computing devices, and things, as in the Internet of things. Wireline access has been replaced by a mixture of wireless and wire technologies, voice switches are being replaced by servers and data routers, and intercity lines are being replaced by a mixture of middle mile, regional, and backbone networks using fiber optics, microwave, coaxial cable, and satellites, mostly using Internet protocols. As in earlier days, persons provide network value, but now the content is in multiple forms, such as web text and features, voice, videos, data and e-commerce transactions, and the value is enabled not just by the physical network, which is evolving to an all Internet protocol next generation network (NGN), but also by virtual networks created in software apps that enable voice, video, photos, text, etc. Such apps include Facebook, Skype, Instagram, and Gmail.

Thus telecommunications is evolving from services provided via specialized networks to services provided by apps residing on generalized networks designed primarily to accommodate data. In considering changing business models it is worthwhile to note that these networks are largely part of the public Internet, which is designed for data. Because a data network is not optimal for providing

voice and video services, some network providers have developed what are called private Internets that are dedicated to voice, video, or data.

This transition in services and networks is disruptive to business and regulatory models that are based on the old network paradigm. For example many traditional telecommunications providers organized their business models around revenue streams for voice communications. As their networks evolve to NGN, some operators find themselves largely as providers of networking for bit streams that apps use to supply valuable customer interfaces for voice communications, as well as for video, pictures, etc. The value of such NGN networks are based on their abilities to allow customers to access apps and to allow app providers to reach customers. In the future the network providers' revenue streams will depend on their abilities to monetize the value that customers find in accessing and using apps, and to monetize the value that app providers place on reaching customers. In instances where the network provider is also an app provider, such as Google and Facebook in some instances, the network revenue streams will also depend on monetizing any network demand that is stimulated by their apps.

In effect the new business models tease apart two value propositions – the value of enabling a form of communication (for example, enabling talking in real time) and the value of the channel over which to communicate -- that were integrated under the old network model. This is troubling for some telecom operators who, rather than adapting to the emerging environment, continue to view the value of enabling voice communications as their sole or at least primary value proposition for customers. The new business model for networking monetizes the value of the channel. This should be commercially viable as the new channel is more valuable than the old one because NGN channels have multiple uses – web, video, etc. –

which should allow operators to charge higher prices than they did for specialized network channels.<sup>4</sup>

The new business model for enabling communication is to charge separately for this functionality, although this is often free to the consumer.<sup>5</sup> For example some voice over Internet protocol (VoIP) providers do not charge for many types of call, such as on-network calls, whether video or voice. Facebook at this time does not charge for real time video broadcasting. In contrast with YouTube, which does not charge for normal video provision, Vimeo does charge and is able to do so by offering higher quality service.

## **II. Failings of the Traditional Approach to Identifying Market Power**

The best practice approach for identifying market power is to first define the relevant market and then to analyze whether there is market power. The process for defining the relevant market has remained essentially the same for several years. It examines markets in two dimensions – product aspects and geographic aspects. In considering the product aspects, analysts attempt to determine whether products that customers view as effective substitutes are reasonably available. Regarding geography, the analyst considers whether customers are limited by geography in their search for products and so examines the degree to which customers can expand their search geographically and whether firms can cross geographic boundaries to serve demand.

<sup>4</sup> We should note, though, that the old prices were for both channel and for enabling voice. So the new channel prices can be higher than the implied channel price under the old model, but not necessarily higher than the actual prices charged for the integrated service. Thus while in our experience operators can and do charge more for networking in a NGN context, this may not always be the case.

<sup>5</sup> Network providers can capture some of this app value even without being an app provider. If prices charged for apps are less than customers' willingness to pay, then network providers' prices can capture part of that value. Also, while in the past networks generally charged only one side of a call, namely the sender, in the new business models, absent certain net neutrality restrictions, networks can monetize the value they provide to app providers by, for example, selling enhanced features that improve app performance. Thus, even if operators are not providing apps, there should be more than enough value in providing channels to make a pure networking play commercially viable. A primary challenge is transitioning from the old business model to the new one. There may also be a profit challenge from commoditization of networking, for example if net neutrality restrictions create homogeneous networks.

Boundaries are identified using a hypothetical monopolist test, which considers whether a hypothetical monopolist within the tested product or geographic boundaries would be able to profitably raise and maintain prices above competitive levels. In applying this test, the analyst first chooses a market definition that the analyst is sure is overly small. Then using historical estimates of market demand, including own-price and cross-price elasticities, the analyst tests whether a hypothetical monopolist could profitably raise prices in this market by a small amount and profitably maintain them. If the hypothetical monopolist cannot do so because customers would find alternative sources of supply outside the presumed market boundaries, then the boundaries being tested are deemed too narrow. The analyst then slightly broadens the market definition and again runs the test. Once the analyst finds a market definition where the hypothetical monopolist can profitably increase its price, then the market boundaries are considered appropriate. (Jamison and Hauge forthcoming)

We address one failing in this traditional approach, namely the problem of analysis decay. The decay problem arises because the traditional approach relies upon historical demand and supply data. While this reliance is appropriate under stable market conditions because it grounds the analyses in real experiences, it provides invalid results when demand characteristics are unstable or unknown, such as in rapidly changing markets and emerging products.

Figure 1 illustrates our analysis of the decay problem. The vertical axis represents  $V_t(A, \omega, d_t, \mathbf{z}_t)$ , the economic value of the regulatory action  $A \in \{0, 1\}$ , where 1 represents the regulator (which may be a sector regulator or competition regulator) choosing to act. Zero represents the choice to not act.  $V_t$  incorporates all economic value created by the regulatory action and all private costs, but not the costs of the regulator, which we define as  $c \geq 0$ .  $t$  designates the time period,  $\omega$  is a vector of exogenously determined weights assigned to the economic interests affected by the regulatory decision,  $\mathbf{z}_t$  is a vector of economic parameters at time

$t$ , and  $d_t = [0, 1]$  is the depreciation rate of the regulatory analysis at time  $t$ . A lower depreciation rate implies a higher value for action at time  $t$ . We assume that the regulatory action occurs when  $t = 1$  and that data, which are some subset of  $\mathbf{z}_{\hat{t}} + \mathbf{z}_{\hat{t}+1} + \dots + \mathbf{z}_0$ , are gathered over the time period  $[\hat{t}, 0]$ , where  $\hat{t} < 0$ . We also assume that the analysis does not weight data with respect to time, i.e., data gathered at any point in the interval  $[\hat{t}, 0]$  are given equal weight in the analysis to data gathered at any other point in the time interval. We understand this to be the common practice. We use a binary regulatory decision to simplify our analysis, but in reality regulators have a variety of options available to them, some of which are more appropriate than others given the economic conditions.

[INSERT FIGURE 1 ABOUT HERE]

The horizontal line  $V^S$  in Figure 1 represents the situation where economic conditions are stable, i.e.,  $d_t = 0 \forall t$ .  $V^S > 0$  when the regulatory action creates economic value and  $V^S \leq 0$  otherwise. We normalize  $V_t$  to 0 for  $A = 0$ . The downward sloping line  $V^L$  represents the situation where the depreciation rate is low, but greater than zero, and the steeper line  $V^H$  represents the situation where the depreciation rate is higher. We show  $V^L$  and  $V^H$  as positive when intersecting the  $V$  axis, but this might not be the case for welfare decreasing regulatory actions.<sup>6</sup>

Figure 1 illustrates value of regulatory action as linear with respect to time, but this need not be the case. For example an action to deny a merger that had no redeeming welfare effects might become of no consequence once the analysis has decayed so much that  $V_t$  becomes zero, but the lack of redeeming qualities would imply that value never becomes negative. Also the rate of decay at  $t$  might be

<sup>6</sup> It is feasible that  $V_t$  could rise during some time periods  $t > 1$  if the future economic conditions are more suited to the regulatory action than those during the data collection period  $[\hat{t}, 0]$ . This would seem to occur by luck since the future state is not reflected in the regulator's analysis, so we limit our examination to situations where regulatory action improves welfare because of the relevance of the regulator's analysis.

increasing with respect to time, implying a concave function, or decreasing with respect to time, implying a convex function.  $V_t$  could be below zero if, for example, the regulatory action prevents cost savings, increases industry or customer costs, or limits innovation.

The decay rate affects the relevance of data from  $t = [\hat{t}, 0]$  in two ways. When data value is depreciating during the collection period, the economic significance of the data is decreasing in  $|\hat{t}|$ , i.e., the economic relevance of the analysis declines as the time period for collecting data grows. However, expanding the time period over which data is collected could increase or decrease statistical significance. More data increases statistical significance all other things being equal. However, if the decay rates are high during the data period, we would also expect greater variances because the true parameters and functional forms are changing with respect to time, which lower statistical significance.

We now consider the effects of regulatory action using traditional analyses when data relevance might decay. We define a traditional analysis as one that uses data from the time interval  $[\hat{t}, 0]$  with no weighting of data with respect to time. Using this approach, a regulator seeking to maximize welfare will regulate if

$$(\bar{t} - 1) \sum_{t=\hat{t}}^0 \frac{V_t(A=1, \omega, d_t=0, \mathbf{z}_t)}{|\hat{t}|} \geq c, \quad (1)$$

where  $t = \bar{t} > 1$  represents the period it is expected that the regulatory action will end. We did not find in the literature instances where regulators explicitly considered administrative costs of implementation, so it may be in many situations that regulators effectively act as if  $c = 0$ .

Assuming that the regulator's choice of  $\bar{t}$  is correct, the actual effects of a regulator's decision to regulate are

$$\sum_{t=1}^{\bar{t}} V_t(A = 1, \omega, d_t, \mathbf{z}_t) - c. \quad (2)$$

Comparing (1) and (2), it is clear that whenever  $d_t \neq 0$ , the regulator's decision-making criteria overstates the value of the regulatory decision, resulting in over regulation.

Figure 1 illustrates this over estimation in the value of regulatory action. The vertical line intersecting points F, G, H and I represents  $t = \bar{t}$ . The regulator estimates the value of regulation to be the area  $0EFG - c$ . The actual value is the area  $0BD - DGH - c$ , resulting in an overestimation of  $BEFH$ . Higher rates of decay of economic validity of the analysis increase this overestimation. In Figure 1, the difference in overestimation with a low rate of decay versus a high rate is  $ABHI$ .

When markets are changing, the overestimation of value of regulatory action is strictly positive, which leads us to conclude that overregulation is a normal occurrence. This is not to say that all regulatory actions are inappropriate, but certainly there is a need for a way to address this overestimation of regulatory value. This dilemma can be answered by focusing on what it is that could provide a firm with market power over multiple generations of markets over time. We call these EFMs and explain their meaning and use in the next section.

### **III. The Enduring Factors Creating Monopoly Approach**

Rather than basing regulatory decision-making on rapidly decaying estimates of market power, we suggest that decision makers should focus on identifying and addressing factors that lead markets to be monopolistic. More specifically, we suggest focusing regulatory concerns on situations where there are endowed or illicit factors that will lead multiple generations of products to be provided by monopolies. We call these enduring factors leading to monopoly (EFMs). Regulatory responses should be limited to factors that cause monopoly across generations of products because, in our context, the life of a single product is too

brief to warrant regulatory action. Furthermore regulatory responses should be limited to factors either endowed or illicit because they are either costless to the firm (in the case of endowed factors) or destructive to market performance (in the case of illicit factors). All other factors must be built or acquired by a firm, and such innovations will be discouraged by regulatory practices that penalize such developments.

We now turn our attention to identifying factors that lead to monopoly. Economists have long recognized that monopolies occur for reasons. Smith (1776) and Mill (1848) identify government barriers to competition as a primary source of monopoly. They also describe how collusive agreements can allow firms to avoid competition. Mill (1848) also describes monopoly arising from situations where essential skills or supply inputs are subject to natural limits. Beginning with Rohlfs (1974) a body of economics literature has developed on platform markets – generally two-sided markets that exhibit network effects – that shows that such markets tend to tip, resulting in a monopoly or near monopoly. Patents and other forms of intellectual property rights can also limit competition.

The most common approach in economics to determining whether a firm is a natural monopoly is to examine the market from a production technology perspective. By this view, a monopoly is a natural monopoly if a single firm represents the least cost arrangement for serving the entire relevant market demand because its costs are subadditive (Baumol 1977, Sharkey 1982). Jamison (1999) adds that a firm must have dominant cost subadditivity for its products to ensure that the firm's supply cannot be more economically provided by any combination of firms, including those outside of these products' markets.<sup>7</sup>

<sup>7</sup> Subadditivity is defined as being less costly for a firm to produce a given level of output than for all possible combinations of two or more firms to produce that output (Sharkey 1982). Dominant cost subadditivity extends this concept by requiring that the monopoly in question provides economies of joint production greater than economies that could be provided by all other forms of organization that might produce some portion of the output of the monopoly in conjunction with products and/or markets that the monopoly does not supply. (Jamison 1999)

The problem with the natural monopoly concept for our purposes is that it focuses on existing products and markets, which could be too short-lived for proper analysis and regulatory treatment. The key question is whether there are factors that will lead to dominant cost subadditivity across generations of products. As far as we can determine, the economics literature on this point is limited. Baumol et al. (1982) provide the most exhaustive treatment and only identify public and quasipublic inputs. A public input is a factor of production that, once acquired, can be costlessly used for multiple products and quantities of production. A quasipublic input is a factor of production that can be subject to complete congestion, but that is not under current and expected circumstances.

Any of the forgoing factors leading to monopoly could be enduring across generations of products. For example, a government barrier to competition or a collusive agreement might be adapted as circumstances change to allow the favored businesses to collect monopoly rents. We are unable to find a clear rule of thumb for knowing when factors are enduring, so as far as we are able to determine they must be identified on a case by case basis.

Once an enduring factor is identified, the next step is to determine whether a regulatory response is appropriate. We believe that some enduring factors should be encouraged because, if regulatory practice makes developing them less economical, then customers will be denied some future innovations.

One recent example of a factor that should be encouraged is the development of a customer base in platform industries. Some economic analyses that find market power in platform markets find that a firm has a customer base that the firm is able to leverage across multiple generations of products. For example, Cremer, Rey, and Tirole (2000) examine market power in the Internet backbone and conclude that embedded customer bases are a source of market power leading to discrimination in connectivity. Missing from their analysis, however, is any consideration of how public policies addressing market power (mergers in their

case) affect the economics of building a customer base. If policies extract that value, then service providers are likely to limit the amount of value that they create for customers. Similarly, Carlton and Waldman (2002) examine generations of software and conclude that an embedded customer base provides a software provider with a competitive advantage that can lead to market power. Similar to Cremer, Rey and Tirole (2000), Carlton and Waldman (2002) assume that the customer base is endowed and so omit from their analysis any consideration of how regulation might affect business incentives to create such a valuable product space in the first place.

We would discourage treating a customer base as a factor that should trigger regulation. As Jamison (2001) demonstrates the opportunity to leverage complementarities across markets stimulates investment in existing markets. A regulatory practice of limiting opportunities for firms that have built their base of customers by developing valuable products would necessarily limit the amount of capital that investors would make available in the future.

#### **IV. Implications for a Current Issue**

A current issue where our analysis is relevant is the case of over the top (OTT) services in telecommunications. These are situations where an app provider, such as Skype, enables customers to communicate using voice or video in real time. The app is provided over the public Internet, which is designed for data, and so the service is sometimes low quality relative to that provided by specialized networks.

Three issues tend to arise with OTT providers. One prominent issue is whether the OTT provider should be considered a telecommunications provider. Per our analysis in Section II, the OTT provider is not a provider of a physical communications channel and so is not a telecommunications carrier but rather a

software interface for customers. The OTT provider does not compete with telecommunications channels and is indeed dependent on them.

Another prominent issue is whether an OTT provider is competition for a telecommunications provider. In our analysis this is the wrong question. It is futile to base policy or regulation on a product rivalry when product definition evolves rapidly: Even if one could conduct a valid analysis, its relevance would quickly decay. Instead decisions on whether to regulate should be based on analyzing whether any operator possesses EFMs. Any service operators that do not should not be subjected to economic regulation, except to address consumer protection issues and perhaps network interconnection. Operators that do possess EFMs, such as government protections, will possess market power over time and over generations of products. How this market power should be address would depend upon the specifics of the situation.

An issue that is less often addressed is the regulator's role in the evolution of traditional telecommunications providers' business models. Sometimes telecommunications providers seek to have regulations imposed on OTT providers. In our analysis this is an issue of how traditional operators will evolve their business models to an NGN world. They certainly need regulatory space to experiment and adapt, for example, by trying different service provisioning and pricing arrangements for providing communication channels. Limiting OTT providers would likely be a mistake in this context, as the restrictions would keep the network providers from learning how customers will value and use networks in a world rich with apps.

## **V. Conclusion**

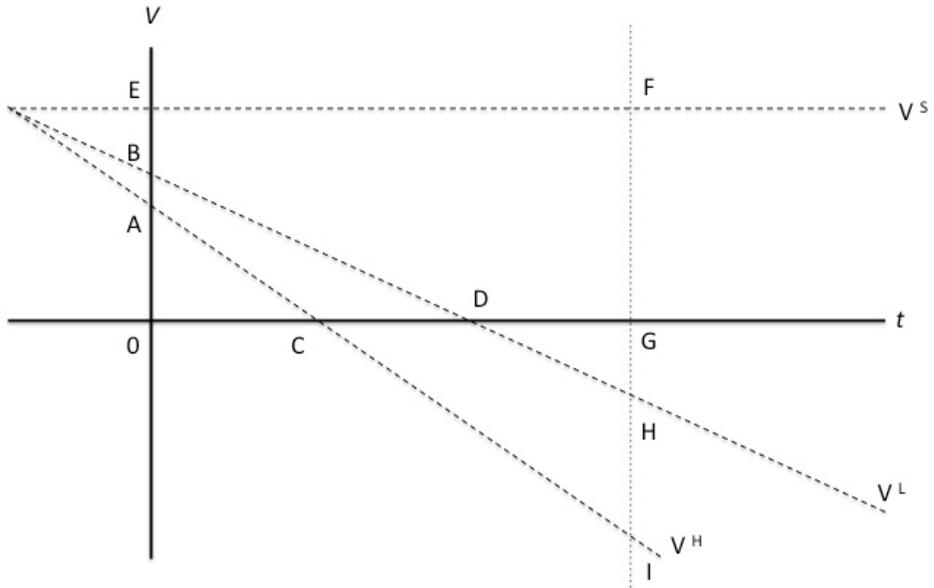
In this article we examine how to consider market power in a world of constant change. We find that traditional approaches fail because they depend on stable

markets. We suggest that a more productive approach is to identify those factors that lead to market power, that endure over generations of products, and that are endowed or illicit.

We have left many questions unanswered. For example we have not identified a systematic approach to finding EFMs. Nor have we developed rules of thumb or classes of EFMs that could guide regulators in knowing how to respond when an EFM is present. These and other questions are left for future work.

# FIGURES

Figure 1. Economic effects of decay





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