

**Analyzing Telecommunications Market Competition:
Foundations for Best Practices**

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Abstract

Competition is an increasingly important theme in telecommunications policy. It has been credited with expanding services, lowering prices, and stimulating innovation. (Jamison et al. 2009) But competition can raise difficult challenges for telecommunications policy makers and regulators. One of these challenges is determining the optimal mix of market and regulatory involvement in determination of prices, services, and investment decisions. In this paper, we provide an overview of assessing market power and competition, focusing on methods of analyzing market competition in order to determine the most appropriate form of regulation as well as merger policy.

Of primary importance is the ability of the government and regulatory authority to accurately define the market prior to being able to consider market power. Markets are defined along both product and geographic boundaries. In terms of products, a market is the set of all products that customers are willing to substitute if prices were to change, and excludes all products that customers do not find to be reasonable substitutes for the products in the market. The market definition includes all suppliers who could create substitutes for these products and excludes all suppliers who could not do so. Geographic markets are defined by the geographic boundaries that customers and suppliers would stay within to provide and purchase these products. Markets are typically defined by using the SSNIP test, but other methods can be used.

Upon defining the relevant market, governments and regulators are tasked with analyzing competition within that market. We discuss methods of identifying market power with specific focus on the telecommunications industry, and consider approaches for determining whether market power is being exercised by firms within the defined market. We examine the typical methods of measuring market concentration, but note that market concentration is not the whole

story. More important than market concentration are the suppliers' abilities to raise prices, barriers to entry and exit, and anticompetitive conduct.

I. Introduction

Competition is an increasingly important theme in telecommunications policy. It has been credited with expanding services, lowering prices, and stimulating innovation. (Jamison et al. 2009) But competition can raise difficult challenges for telecommunications policy makers and regulators. One of these challenges is determining to what degree market forces are disciplining service providers so that regulation can relax its direct control of prices, services, and investment decisions. Regulators in developing and developed countries alike have faced this challenge. Indeed, it has been central to recent proposals for reforming telecommunications regulation in the European Union and to merger analysis in the Caribbean, to name a few.

The purpose of this paper is to examine appropriate methods for evaluating when telecommunications markets are effectively competitive, which means that market forces are disciplining operators. More specifically, effective competition means that service providers, either jointly or individually, are unable to sustain prices at a level that provides excess profits.¹ There are many methods of analyzing competition and market power; however special considerations are essential for analysis of telecommunications competition given two factors that are critical in the case considered: unique aspects of the telecommunications industry such as network effects and interconnection, and the role of regulatory intervention. We cover these in this paper.

This paper proceeds as follows. Section II provides an overview of the importance of analyzing market power in the context of the telecommunications industry with its associated unique characteristics, and introduces definitions needed to address market competition. Section III includes the bulk of the analysis of market power and competition in telecommunications,

¹ We define effective competition more thoroughly below.

with special attention to issues that may be of particular interest to developing countries. Section IV concludes the paper.

II. Overview of Market Power and Competition

A. Efficiency and Competition

Generally people use the term competition in reference to markets in which firms must compete strongly for sales. Each firm attempts to gain customers at the expense of other firms, and through their competition, market price and quality are affected to the benefit of those customers. The extreme case for competition is called perfect competition, which is the situation in which no individual supplier in the market can individually influence the market price (i.e., each firm is a price taker) and each supplier can sell however much it wants at the prevailing market price. While the telecommunications industry almost never fits this perfectly competitive market paradigm, it is possible for the telecommunications industry to exhibit efficient, or effective, competition, which is often defined as the situation where:

- “Buyers have access to alternative sellers for the products they desire (or for reasonable substitutes) at prices they are willing to pay,
- Sellers have access to buyers for their products without undue hindrance or restraint from other firms, interest groups, government agencies, or existing laws or regulations,
- The market price of a product is determined by the interaction of consumers and firms. No single consumer or firm (or group of consumers or firms) can determine, or unduly influence, the level of the price, and

- Differences in prices charged by different firms (and paid by different consumers) reflect only differences in cost or product quality/attributes.”²

In such a market, suppliers are able to freely enter and exit, there are a large number of firms, the market price reflects marginal costs,³ and the service quality and services provided are determined by market forces. The establishment of effective competition therefore should result in the presence of these characteristics.

The goal of effective competition is to promote economic efficiency. Economic efficiency incorporates three concepts of efficiency: Allocative efficiency, technical efficiency, and dynamic efficiency. Allocative efficiency is the situation where the economy’s resources are put to their most valuable uses.⁴ It is important because it helps maximize the value that customers receive from the services provided. Economists refer to this as maximizing net consumer surplus, which is the difference between the prices paid and the value customers expect when purchasing the service.

When a firm exercises market power, there is an efficiency loss to the economy that results from resources being misallocated. The misallocation comes from the firm exercising market power restricting its output to increase profits. When output is restricted in this way, the resources that should be used for this market are used in other parts of the economy where economic value is lower. For example, suppose that a country allowed its mobile services to be provided by a monopoly. The monopolist, if it wanted to maximize its profits, would limit the

² ICT Regulation Toolkit <http://www.ictregulationtoolkit.org/en/Section.1674.html>, accessed 20 April 2008.

³ Marginal cost is the measure of how much the operator’s total cost changes when output changes by a small amount.

⁴ More technically, allocative efficiency is achieved when a quantity is produced such that price equals the minimum long-run average cost of production, and also equals marginal cost.

size of its customer base so that it would sell service only to those customers willing to pay high prices. As a result of this supply restriction, some marketers, engineers, managers, etc. who would be very good at providing mobile services are not put to work providing the services. Instead they work in other jobs where they provide less value to the economy. This is a loss in allocative efficiency because the economy would be better off if these marketers, engineers, managers, etc. worked in the telecom sector.

In addition to this misallocation of resources, some of the consumer surplus that would be obtained under a competitive environment disappears.⁵ Some economists believe that the loss of allocative efficiency is the primary detriment of market power. To measure misallocation, data on the costs of production, specifically how fast average cost increases or decreases with output; the degree of mark-up in price over marginal cost; and elasticity of demand for the product.⁶

Economic efficiency also includes internal efficiency, also called productive efficiency or x-efficiency, whereby costs are kept at a minimum for all levels of output and service quality. X-efficiency addresses the tendency for managers of firms with market power to become less vigilant about keeping costs as low as possible. In large dominant companies, positive profit hides inefficiencies better than possible in a truly competitive firm. x-inefficiency occurs when employees do not work at maximum levels, and when inputs are wasted (for example when the firm buys more inputs than it would have had the managers taken greater care to contain costs). The result is actual costs that exceed the minimum possible cost. This difference is the amount of x-inefficiency within the market. (Leibenstein, 1966)

⁵ The amount of this loss depends on the elasticity of demand for the good as well as the slope of the firm's average cost curve.

⁶ For additional details on the costs due to loss in allocative efficiency, see Crowling and Mueller, 1978.

Finally, economic efficiency includes dynamic efficiency, which occurs when product and production innovations occur at their most appropriate rates. Product innovation is occurring at the proper rate when the extra costs of developing and implementing innovation are equal to the extra value created by the new products. Production innovations occur at the appropriate rate when the extra costs of the innovation are equal to the production cost savings that they create. In short, effective competition results in a competitive balance in which no firm remains dominant and the industry exhibits efficiency of all types.

Effective competition is desired to promote customer benefits through improved efficiency; however when competition is ineffective, regulatory involvement can improve efficiency. This is not to say that regulatory oversight always improves the situation – regulation can be imperfect just as markets can be imperfect – so a difficult decision for policy makers and regulators is to know when regulatory intervention is appropriate and what form of regulatory intervention can actually benefit customers.

Another common concept for competition is the notion of contestable markets. A market is said to be contestable when it is subject to “hit and run” entry, which is the situation where an entrant can quickly enter a market and displace an incumbent, in fact before the incumbent can even react. Contestable markets do not exist in practice, so practitioners generally use the contestable market standard to emphasize the importance of barriers to entry and exit.

B. Market Analysis for Determining the Appropriate form of Economic Regulation

Often in regulation the purpose of assessing market competition is to determine whether economic regulation is needed and, if so, the degree and form of regulation. Figure 1 illustrates the basic framework. The gray bar across the top of the figure illustrates the continuum of

degrees of competition. The left side represents effective competition. The figure labels this as “decentralized market forces” to emphasize the notion that no company, person, or institution is able to direct the market outcomes. Rather, individual decisions by customers and service providers come together to determine what services are offered, service quality, prices, and output. The far right side represents monopoly. It is also called “centralized” to emphasize that, absent regulation the monopoly operator is able to choose the services, quality, and prices (or output) that benefit it the most. If regulation intervenes, then the regulator is the centralized decision maker for at least some of the price, output, and quality issues. Figure 1 denotes competition as “impersonal” to emphasize that each operator and customer makes his or her own decisions. Regulation of monopoly is also labeled as “impersonal” to emphasize that regulation is to be independent of special stakeholder and political interests.

The second (purple) bar in Figure 1 illustrates the dominant form of regulation of the market. When competition is fully effective, then competition law or ex post regulation is the dominant form, although regulation of interconnection might still be appropriate. When there is no competition, then utility style regulation, or ex ante regulation, is typically used.

The third (green) bar illustrates the forms of price controls that might be appropriate for different degrees of competition. In the case of full competition, ex post regulation dominates, so the primary tools are those of the competition regulator. These tools include the Lerner Index and market concentration ratios, which are used to assess whether the market is competitive, and to detect possible predatory pricing. If markets are not fully competitive, then regulators will typically use some form of price cap regulation, which is a form of regulation that limits how much an operator can change its prices without directly controlling the operator’s profits. Price caps are used when competition is weak because the caps limit the operator’s ability to raise

prices in the markets that lack effective competition. If competition is weaker, such as in the case where competition is new or rivals are fledgling and easily driven from the market, the regulator might impose competitive safeguards, such as price floors that limit a dominant firm’s ability to drive rivals from the market through predatory pricing or cross subsidy. Finally, when there is no competition, regulators often use rate of return regulation or price caps in combination with rate of return tools to control prices. Rate of return regulation is the form of regulation where price levels are set by the regulator to allow the operator to receive a particular level of profit from the market. Price caps may also be used in these situations, but generally they include some elements of rate of return regulation such that price levels are adjusted periodically according to the level of profit that the operator is receiving from the market.

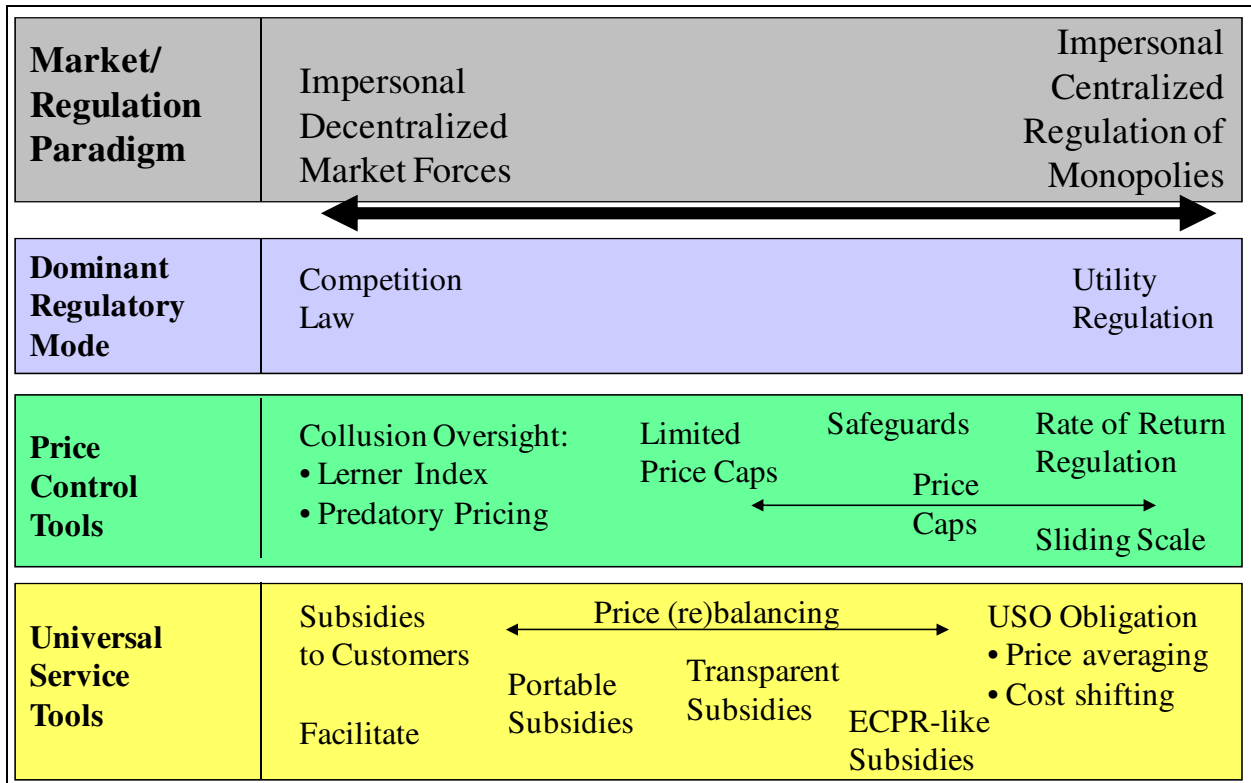


Figure 1. Matching Regulatory Policies with Market Competition

The bottom (yellow) bar in Figure 1 illustrates how universal service mechanisms are affected by the degree of competition. In the case of competitive markets, universal service should fit seamlessly into the workings of the competitive market, meaning that the primary interest of universal service schemes in competitive markets is in promoting affordable prices for poor customers if that is needed. In the case of monopoly markets, regulators will typically use price averaging and internal cross subsidies to promote universal service goals.

C. Using Competition Analysis in the Context of Mergers

At its simplest, a merger combines two or more firms into one. Mergers can be either horizontal (firms producing similar products merge), vertical (a producer merges with a provider of inputs), or conglomerate (firms producing unrelated goods merge). It is beyond the scope of this research to examine why companies choose to merge either amicably or under hostile conditions (i.e., takeover). We will, however, address mergers that appear to be harmful to competition and explain how some regulatory authorities determine which mergers should be allowed and which should not.

The main concern with mergers is that they allow a greater concentration of market power and they may be inefficient. For example, in the year 2000 the U.S. Department of Justice (DOJ) blocked the proposed merger of MCI WorldCom and Sprint over concerns that the merger would increase market power in the Internet backbone and decrease competition in the U.S. long distance market. If the DOJ had been correct in its concerns, the merged company would have been able to restrict output in the Internet backbone and in the U.S. long distance market. While most merging firms cite increased efficiency and exploitation of economies of scale as primary

motivations for merging, empirical evidence suggests such increased efficiency is not a typical result of mergers (see Ravenscraft and Scherer, 1987). Indeed the study found that, on average, efficiency often falls following mergers.

The DOJ Antitrust Division evaluates mergers using specific guidelines:

“1.51 General Standards

a) Post-Merger HHI Below 1000.⁷ The Agency regards markets in this region to be unconcentrated. Mergers resulting in unconcentrated markets are unlikely to have adverse competitive effects and ordinarily require no further analysis.

b) Post-Merger HHI Between 1000 and 1800. The Agency regards markets in this region to be moderately concentrated. Mergers producing an increase in the HHI of less than 100 points in moderately concentrated markets post-merger are unlikely to have adverse competitive consequences and ordinarily require no further analysis. Mergers producing an increase in the HHI of more than 100 points in moderately concentrated markets post-merger potentially raise significant competitive concerns depending on the factors set forth in Sections 2-5 of the Guidelines.

c) Post-Merger HHI Above 1800. The Agency regards markets in this region to be highly concentrated. Mergers producing an increase in the HHI of less than 50 points, even in highly concentrated markets post-merger, are unlikely to have adverse competitive consequences and ordinarily require no further analysis. Mergers producing an increase in the HHI of more than 50 points in highly concentrated markets post-merger potentially raise significant competitive concerns, depending on the factors set forth in Sections 2-5 of the Guidelines. Where the post-merger HHI exceeds 1800, it will be presumed that mergers producing an increase in the HHI of more than 100 points are likely to create or enhance market power or facilitate its exercise. The presumption may be overcome by a showing that factors set forth in Sections 2-5 of the Guidelines make it unlikely that the merger will create or enhance market power or facilitate its exercise, in light of market concentration and market shares.”

From: Horizontal Merger Guidelines, U.S. Department of Justice and the Federal Trade Commission, 1997.

^{7 7} The HHI is calculated as the sum of the squared market shares of all firms in the market. It is discussed in greater detail below.

These guidelines are not simply numerical calculations though. The DOJ must effectively define both the product and geographic markets, identify firms in the market, and calculate market shares prior to determining the concentration within the market in question. The agency's views with respect to these other tasks also can be found in the referenced document.

With respect to vertical and conglomerate mergers, also called non-horizontal mergers, of primary importance is determining whether such a merger would adversely affect competition in the market. Harm to perceived potential competition and harm to actual potential competition must be taken into account. These considerations are more subjective; merger analysis of this type requires case-by-case research. Because firms attempting such mergers operate in different markets, the standard quantitative tools are not useful (except to consider the concentration of an upstream market to see if upstream market power is being solidified to deter downstream entry). In other words, non-horizontal mergers may occur in an attempt to create barriers to entry. In these cases, requests for approval to merge must be carefully considered prior to regulatory consent.

In summary, proposed mergers must be evaluated in the light of the individual markets and firms requesting merger approval. The relative market power of each firm must be considered, and the potential outcomes of the merger must be weighed to determine whether the benefits of the proposed merger are greater than the costs to social welfare and economic efficiency. Legislative guidelines are useful tools; thoughtful and thorough analysis of mergers on a case-by-case basis is essential.

D. Market Definition

Assessing the competitiveness of a market occurs in two basic steps. The first step is to define the market. As we explain in this section, defining the market essentially involves determining the extent to which customers can find alternatives and the extent to which suppliers can create alternatives. In general, we consider all closely substitutable goods to be in the same market and all goods not substitutable to be in another market. Upon defining the relevant market, the second step in assessing market competition is to determine the extent to which a firm or firms can restrict output or raise prices above competitive levels. We address the market definition issue in this section.

Defining the market is perhaps the most critical step to determining the competitiveness of the market. Indeed the conventional wisdom is that market definition is the critical step because the indicators for identifying market power are in some sense rote once the market is defined. As recent as 20 years ago the telecommunications market was much easier to define. It involved primarily landline telephone service for the majority of the population. Currently, telecommunications services are much less obviously within a single market. The predominance of mobile telecommunications services, broadband, satellite, and cable has clouded the market and has made market definition much more complex.

In essence, markets are defined by demand conditions -- buyers deciding among goods and services with different degrees of substitutability for them -- and supply conditions -- the opportunity for alternative suppliers to create substitute goods. Because defining the market is no longer straightforward in telecommunications, it is important to understand methods of determining whether these services mentioned are substitutes within the same market or not.

We consider first the methods of defining a market in product space. Product space refers to how similar a given product is to other related products. For example, for a consumer wishing to make a telephone call, a landline phone and a mobile phone might be considered to be in the same market with respect to product space because either can satisfy the demand for making a phone call. However, for a consumer interested in accessing the Internet via dialup service, a mobile phone might not satisfy his demand and therefore would not be a substitute for a landline phone (i.e., in the same market with respect to product space).⁸

While the concept of product space seems straightforward, some theories examine and expand on this idea in a manner important to the telecommunications industry. In some consumer theory models (Lancaster, 1966, 1971, 1979; Becker, 1965), the characteristics of commodities factor into consumer preferences so that a product is defined more completely as a compilation of characteristics. This means that consumers do more than compare products; they compare characteristics of products. There exists an axis for each characteristic so that each brand can be located on the axis according to its characteristics. For example, with respect to telecommunications services we might have characteristics describing how mobile the product is (landline being completely non-mobile; cellular with full connectivity across the country being completely mobile); alternatively, we might consider characteristics describing the speed of information upload and download. These theories highlight the importance of determining consumer preferences and demand in any analysis of competition and market power.

In addition to product space, markets are defined by geographic space. Such a definition of the market is relatively straightforward. If the products are available in the same geographic

⁸ In some countries, mobile providers are adapting their service to make it more usable for Internet access; for example, by providing modems that can be plugged into personal computers.

area they are considered to be substitutable and therefore in the same market. With respect to telecommunications services, geographic space is rarely a limitation in developed countries. Access is ubiquitous so that geographic barriers do not play a role.

Because substitutability of demand is the main determinant of a market with respect to the demand side, it is imperative that the degree of substitutability of products be properly determined. Technically, substitutability can be defined using the cross-elasticity of demand. The cross-elasticity of demand shows how much a change in the price of one product affects the quantity demanded of another product. For example, if a 5 percent increase in the price of mobile service were to cause customers to increase their purchasing of landline phones by 5 percent, then we would say that the cross-elasticity of demand was 1. If there is a high positive cross-elasticity of demand, the goods are substitutable. If there is not, the goods are in different markets. For example, to determine whether high speed is a close substitute for dial-up Internet, one might use the following formula:

$$\text{Cross-elasticity of demand between dial-up and high speed} = \frac{\% \text{ change in quantity of high speed}}{\% \text{ change in price of dial-up}}$$

A high positive cross-elasticity of demand would imply the goods are in the same market. A low cross-elasticity of demand would imply the goods are in separate markets.

A form of this cross-elasticity method of defining the market was outlined in 1982 by the Antitrust Division of the DOJ. This method has been referred to as the SSNIP test, where SSNIP stands for the test of Small but Significant and Non-transitory Increase in Price. It was used in 1992 in the European Union in the Nestle/Perrier case, and was accepted by the European Commission as a viable method for estimating competition shortly thereafter (1997). The idea

behind this method of measuring the substitutability of goods is to consider a market as the area within which the price of the good could profitably be raised. If this rise in the price of a good over a year creates a significant shift of buyers (again generally assumed to be about 5 percent) to another good, the goods are in the same market; a change in the price of one good affects the quantity purchased of the other, indicating the goods serve as substitutes and therefore must be considered to compete in the same market for consumers. The circle of goods in question is continually expanded until a hypothetical increase in price no longer causes a loss of a significant number of consumers. This defines the edges of the market.

To illustrate the operation of the SSNIP test, consider the situation where a regulator is trying to define markets to analyze a proposed merger between two mobile operators that offer only prepaid mobile. The regulator would begin her analysis by defining the market very narrowly -- that is to say, more narrowly than the regulator thinks is likely to be true. So in our example, she might define the market as prepaid mobile service using cards that come in U\$10 denominations. The regulator would then ask: If this market were served by a monopoly firm, could the monopolist profitably increase its price by a small, but significant non-transitory amount (generally 5 percent)? The regulator would probably find that if the price of a 300-unit card were increased from US\$10 to US\$10.50, many customers would switch to cards with different numbers of units, say to cards with 400 units. This switch would mean that the price increase would not be profitable. The regulator would conclude that the market is defined too narrowly and would expand her market definition perhaps to include all prepaid cards. Then the regulator would repeat her experiment by asking whether a hypothetical monopolist serving this market could profitably raise its price by 5 percent. If the answer were “yes”, then the market would be defined as prepaid mobile cards and the regulator would then proceed to analyze the

potential impact of this merger on the degree of competition in the market. If the answer were “no,” then the regulator would expand her market definition, perhaps by including low-usage post-paid phone pricing plans. She would repeat her SSNIP analysis until she reached the point where a price increase would be profitable, which would mean she had found the edge of the market, that is to say, the boundary of the product beyond which customers would not view products as substitutable.

Carrying out the SSNIP test in practice can be difficult because of the information requirements. To fully conduct the analysis in our previous example, the regulator would need to know the cross-elasticities of demand between prepaid cards of various denominations, between prepaid mobile and various post-paid calling options, between prepaid mobile and pay phones, between prepaid mobile and fixed line, etc. Generally there exists an inability to raise the price of one good and watch the resultant change in quantity for the other, so analysts instead perform econometric studies of price and cross-price elasticities, but these studies are data intensive as well. Additionally the SSNIP test is subject to criticism because no strict guidelines exist as to the degree of price change that might be expected to cause a change in a potential competitive good, or the time frame in which such a change might be expected to occur. While this method has been criticized as unreliable due to the inability to perform tests practically, it still remains in common practice and is useful to define a framework which may be confirmed through use of traditional evidence. It might be viewed as a first-best approach to defining a market.

If a regulator lacks the data to perform a SSNIP test as outlined above, substitute methods might be developed. For example, the New York Public Service Commission Staff performed something like a SSNIP test; where they lacked complete data, they conducted sensitivity analyses to see whether the missing data would impact the answer. They found that only in

extreme values did the missing data matter, so they were able to make recommendations even with incomplete data. Another option for dealing with missing data might be to use estimates from countries with similar markets or to rely upon expert panels to formulate opinions on the degree of substitutability among goods or on market boundaries.

Competition authorities have relied to some degree on practical evidence for assessing whether competitors are truly in the same market with respect to product type. Shephard and Shephard (2004) explain that there are four criteria for defining market type in the absence of more quantitative measures. The first relies on the experience of those judging the market; with respect to the general character of the goods, one asks whether the goods can be reasonably expected to be substituted for one another. If so, they may be in the same market. The second criterion relies on the market participants. Firms believed to be competitors of one another generally are, and because those market participants depend on successfully competing against their rivals, it is likely they are well-informed about whom their closest competitors are. The third criterion considers whether the goods are sold by separate sellers. If so, the goods may be in different markets. Different sellers may be able to charge different prices without losing customers. This would suggest the products sold are in different markets. Finally, authorities can assess whether the prices of goods move together or independently. If the prices move together, it suggests the goods are substitutable and therefore that those goods should be considered to be in the same market.

An issue of larger significance in non-infrastructure industries is defining firms within a market, and firms that may potentially enter the market. In the former case the telecommunications industry holds certain advantages. Primarily, there are characteristics of the industry that require that firms within the industry identify themselves as such. For example, the

requirement for licensing and regulatory oversight ensures that firms in telecommunications markets are known. Of greater difficulty is determining firms that may enter, i.e., potential competitors. This goes to the issue of supply substitutability. The rapidly advancing technological environment in some countries leads to the possibility of extensive cross-over among telecommunications providers and cable, broadband, and satellite providers. While most of these competitors are known by government regulatory authorities, the probability of their entering similar markets is not as clear. Economies of scale⁹ and scope may exist that promote entry into complementary markets, blurring the market definition further. This results in the possibility of anti-competitive behavior to preclude such entry by rivals. (This topic is addressed below.) It also results in the need for regulatory authorities to carefully monitor and assess consumer preferences and demand so as to accurately determine both elasticity of demand and the substitutability of products within and across markets.

Analysts address the issue of supply substitutability by performing SSNIP tests, similar to the ones described above. However, in the supply side SSNIP tests the analyst asks whether the hypothetical price increase would trigger a response from a potential supplier.

III. Analyzing Market Competition

A. Identifying and Defining Market Power

A standard manner of analyzing market power is to begin with market shares. The market share is the firm's percentage share of the market's total sales revenue. Clearly in order to determine market share it is imperative to correctly identify the relevant market, which we

⁹ Economies of scale refer to the level of production in which the average cost of production is falling with output; economies of scope refer to the case in which production of two goods together is less costly than production than the total cost of producing the goods separately.

discussed above. Firms with higher market shares are thought to have greater degrees of control over price and quantity, and have correspondingly higher profits. However, market share does not provide all the relevant information needed to analyze market competition. There are additional indicators of market power that are based on and spring from market structure.

The most closely related use of firms' market share is in defining how competitive an industry is. The combined market shares of the dominant firms within a market are important in determining such competition. Concentration is the broad term used to represent the combined market shares of firms. While knowing the concentration within a market does not provide conclusive evidence as to the competitiveness within that market, it is a useful descriptive statistic that provides a general idea of the industry. The effects of concentration depend on the interactions among firms within a market. For example, a highly concentrated market may be represented by three firms each serving an equal number of all customers. If these three firms engage in strategic cooperative behavior such as collusion in setting prices or creating barriers to further market entry, consumer welfare may decrease (as would be the case if a cartel or monopoly existed). Alternatively, if the three firms engage in non-cooperative strategic behavior or direct and strong competition, firm's profits may instead suffer and consumer welfare may be higher than would be the case under a cartel or monopoly.

B. Market Shares and Concentration: HHI and C4

There are two primary methods of calculating market concentration. One method is the four-firm concentration ratio, or C4. The C4 ratio adds the market shares of the top four firms in the industry. For example, in the United States, divested local telephone companies were obligated to install switching equipment that allowed for equal access by any long distance

company. AT&T's market share subsequently began to fall. By 1991, AT&T's market share was approximately 61 percent, MCI served 17 percent of the market, Sprint served 10 percent, and the next largest company had about 1 percent of the market. This means the C4 concentration ratio was 0.89, relatively high. Before the breakup of AT&T however, the company held approximately 95% of the U.S. long distance market. The C4 therefore was even higher prior to divestiture. (Ward, 1995) These figures serve as rough guides to market power; a higher C4 indicates that additional consideration of whether market power exists might be useful, while a lower C4 means there is less cause for concern. Still, the C4 carries a disadvantage in that it accounts for only a small portion of all firms. This means that a high C4 could be as a result of two very large firms, or more but smaller competitive firms.

The more widely used measure of market concentration is the Hirschman-Herfindahl Index (HHI). The HHI is used by the DOJ in antitrust and merger cases as described above. The HHI is calculated using the market shares of all firms rather than only the largest four. The HHI is calculated as the sum of the squared market shares of all firms in the market. The HHI for a pure monopoly would be 10,000 (i.e., one firm with 100 percent of the market). The DOJ threshold indicating a tight oligopoly is generally held to be 1,800. Values below 1,000 involve no significant market power. In general the numbers serve as useful guidelines, but there is no definitive criterion at which an HHI is deemed to be too high for effective competition.

C. Excess Profits

The C4 and HHI are methods for determining the degree to which a market is concentrated, but they do not tell us whether firms possess or are exercising market power. One clear indicator of the exercise of market power may be profits because the purpose of exercising

market power is to receive supernormal profit. To be useful as an indicator of market power, profit should be calculated as a percent of capital (or rate of return on equity). The return on equity compares directly with a company's growth rate. It is essentially represented by dividing total profit by the value of the capital assets employed.¹⁰ In general we would expect firms in competitive markets to receive a return on capital that is equal to their weighted average cost of capital (WACC) on average (where the weight refers to a weight on the source of financing; each source has a different price, so the weight allows each source's price to be taken into account in the overall financial figure). The WACC is the estimate of the cost for the firm to raise capital from debt holders and equity holders. Knowing the WACC for a firm is difficult in developing economies because capital markets are not well developed; the prices of various sources of financing are not well defined. A reasonable proxy might be to compare the rate of returns of the telecommunications firms of interest to those of other firms in the economy that face business risks similar to the telecommunications firms. If the telecommunications firms consistently receive rates of return that are on average comparable to other firms in the economy, then we would expect that the telecommunications markets are equally competitive. If on the other hand the telecommunications profits tend to be high compared to the rest of the economy, then we would want to analyze further to see if the higher profits were the result of superior performance or the exercise of market power.

One caution must be taken when considering providers' profits. In some instances, the possibility of profiting from product innovation or improved efficiency provides incentives for

¹⁰ Countries vary in how they measure capital asset value. Some countries use historical accounting values, in which case the value used is the sum of the original cost of each asset less the accumulated depreciation. Other countries use current accounting values. In these cases the original costs are adjusted according to inflation and accumulated depreciation is still deducted.

firms to engage in win-win activities that benefit consumers and provide the firm with greater profits. If such innovations and efficiency improvements are important for a country, it might be useful to consider whether any observed market power has resulted from activities that are beneficial to consumers rather than from anticompetitive actions. Explicitly including such considerations in a formal policy might signal to operators that they are more likely to profit from welfare improving activities than from anticompetitive practices.

D. Elasticity of Demand

Market power may be evidenced by the elasticity of demand for a firm's product. As discussed above, elasticity essentially defines a product's substitutability with respect to other products. As the demand curve becomes less elastic, consumers are less willing to do without the good. This means an increase in price results in less of a decrease in quantity than if demand were more elastic. Hence, the firm clearly has market power.¹¹ The exercise of that market power, however, is not explicitly evident from elasticity.

¹¹ A more quantitative explanation relies on the fact that firm profit maximization requires choosing the optimal quantity such that marginal revenue equals marginal cost. Beginning with the profit equation, $\text{profit} = P \cdot Q - C$, where P represents price, Q represents output, and C represents total cost, if we differentiate with respect to Q we find that marginal revenue (MR) = $P(1 + (1/\epsilon))$, where ϵ is the elasticity of demand. By substituting marginal cost (MC) for MR (because they are equal at the profit maximizing output), we find that $(P-MC)/P = - 1/\epsilon$. The left side of the equation is the price-cost margin known as the Lerner Index. As the equation shows, the price-cost margin depends only on the elasticity of demand for the product if elasticity is constant. Regulatory authorities therefore can use the Lerner Index as an indicator of a firm's market power as it reflects the ability of the firm to mark up its product without losing consumers to competitors offering close substitutes for the product. Further mathematical calculations show that the Lerner Index is equivalent to the HHI.

E. Scale economies: MES and cost gradient

Scale economies refer to cost savings that occur as output increases. Scale economies derive from a firm's production function: the amount of output a firm can produce with any given level of inputs and technology. Scale economies can be determined by analyzing the result of a given increase in all input quantities. For example, if all input quantities are increased by 1 percent and output increases by more than 1 percent, the market exhibits increasing returns to scale, or economies of scale. If output increases by exactly 1 percent, the market exhibits constant returns to scale. If output increases by less than 1 percent, the market exhibits decreasing returns to scale. Increasing returns to scale are likely to occur when there are organizational gains from a larger size firm (and when specialization occurs). When a firm exhibits increasing returns to scale, the firm's long-run average cost curve is increasing, which means that an increase in output leads to a fall in the average cost of production.

We can use information regarding scale economies as a proxy for the ability of a firm to serve a large share of the market; in other words, there are some industries with a market structure that supports a high concentration ratio due to the existence of scale economies. There are two considerations: the quantity of production at which average cost is at its lowest, and the speed at which costs decline with output. These considerations are represented by the minimum efficient scale (MES) and the cost gradient that are exhibited by a firm in the market. By definition, a firm's MES is the smallest output the firm can produce so that its long-run average costs are minimized. The low-point of average cost could occur at any level of production. The size of the MES firm is useful for judging how many firms could profitably operate in a market. The cost gradient indicates how much leeway a firm has in its choice of production around the

minimum average cost. If the cost gradient is steep, MES is defined precisely as a particular quantity. If the cost gradient is more flat, MES may extend over a range of output.

One caution when using MES analysis is that the instrument does not easily lend itself to analyzing rapidly changing markets, markets with differentiated products, and alternative technologies. MES is less effective in changing markets because it considers the cost structure for existing technologies and not how firms' investments in new technologies affect firm viability. This means that the measure lags behind what actual figures would indicate in technologically advanced industries like telecommunications. Lastly, existing markets are inexact representatives of potential markets. The existing technologies and cost structures may not be the most efficient or most profitable due to the market structure. A different market structure may allow improved innovation and decreased costs; however the MES has no mechanism to account for such possibilities. For example, it was commonly believed prior to the breakup of AT&T that the firm was a natural monopoly because its technology choices made it look like a natural monopoly. But studies subsequent to the breakup showed that the prior beliefs were wrong.

F. Barriers to Entry and Exit

Barriers to entry refer to anything that inhibits potential competitors from entering a market or existing competitors from expanding services in terms of diversity of products or geographic space. This includes barriers that restrict entry and also barriers that slow entry. There are three primary types of barriers: legal, economic, and strategic. Of the forms of barriers to entry, legal and economic barriers are generally exogenous, while strategic barriers are endogenous. Shephard and Shephard (2004) provide a comprehensive list of both exogenous and

endogenous barriers. In the telecommunications industry, some of these barriers are seen more frequently than others.

Legal barriers are generally held to be exogenous as they are not directly under the incumbent firm's control but rather result from the structure of the market and/or the influence of a regulatory authority. In telecommunications, licenses may serve as barriers to entry. Alternatively, if a regulatory authority requires too cumbersome administrative work or costly payments to gain the right to provide service, this too acts as an entry barrier. Formal barriers set up by governments serve as exogenous barriers to entry. Industries that are protected by government requirements, restraints, and preconditions are much more difficult and costly for potential entrants to penetrate. Effective regulatory policy can limit these barriers.

Economic factors may generate barriers. Early work stressed that barriers to entry depended on the market structure so that markets of a particular type would be more prone to the existence of such economic barriers. The telecommunications industry (and all infrastructure industries) holds characteristics most susceptible to this anti-competitive possibility: the markets are large with large economies of scale (i.e., large fixed costs). These high fixed costs serve as a barrier to entry in the absence of regulatory involvement precluding such. Market characteristics that affect the ability of a firm to enter the market are other exogenous conditions precluding entry as they are not necessarily under the incumbent firm's control. (Bain (1956) is the seminal work with respect to the systematic study of barriers to entry.)

Scale economies also can play a significant role in limiting entry. The existence of scale economies and large sunk costs to enter implies that an entrant must plan to serve a large share of the market, which would require a high level of capital. The regulatory authority could act to

lessen or remove that barrier by imposing interconnection and access rights to essential facilities in order to aid competitive entry.

Finally, strategic actions by incumbent firms may serve to erect barriers to entry and/or inhibit expansion of a competitor's network. These barriers are considered to be endogenous barriers; they are factors within the incumbent firm's control that similarly deter entry. Most of the barriers refer to discretionary actions that may be used by the incumbent as part of its strategic behavior to gain or maintain market power. For example, customer lock-in and high switching costs serve as barriers to entry for new firms. If potential entrants must incur additional costs to assist consumers to switch to their product, the likelihood of profitable entry decreases. Product lock-in and switching costs are particularly important in an analysis of telecommunications services. While number portability makes switching providers easier for consumers, lock-in still occurs. While in some ways switching costs are inherent in the industry and to the product type, such costs may also be considered endogenous barriers to entry. Many providers continue to offer incentives for consumers to lock themselves in with a particular producer, for example by offering a high-quality cellular telephone free upon agreeing to a two-year service contract. Such a practice is referred to as non-cooperative strategic behavior. This refers to actions taken by firms to reduce competition by both actual and potential entrants in order to improve their position relative to their rivals and thereby maximize profits. (Schmalensee, 1982; Klemperer 1987). Lock-in is a form of non-cooperative strategic behavior called "raising rivals' costs." Because the profitability of firms in oligopolistic markets is interdependent, if a firm can costlessly raise its rivals' costs relative to its own it can gain market power over that rival. If it is difficult for consumers to switch providers, this raises the rival's marketing costs and lowers demand for the rival's product. This not only provides an advantage

to the firm with the ability to raise its rivals' costs, but it discourages potential entrants and further entrenches the dominant firm in the market.

Endogenous sources of barriers to entry are many. Of primary importance are controls over strategic resources. For example, in the telecommunications industry, those companies owning telecommunications lines might have a strategic advantage and an incentive to limit access to those lines if a significant portion of the market is already served by such a company and substitutes are not economical.

Raising rivals' costs are other ways of erecting barriers to entry. In addition to the lock-in discussed above, firms engage in a number of other ways to erect barriers. These issues are closely related to discriminatory tactics and predatory actions, and a firm's ability to engage in such practices is an indicator of an incumbent firm's market power. For example, in order for a firm to practice price discrimination, it must have a relatively inelastic demand for its product, meaning there are no close substitutes that a consumer would be willing to purchase instead of that product. Price discrimination can reduce competition depending on the firm's position within the market, and how systematic the discrimination is. If discrimination is systematic for a firm with a high market share, such discrimination is considered to be anti-competitive. Anti-competitive behaviors generally are of concern when a firm's actions are selective and market shares differ greatly from rivals. If these conditions do not hold, pricing actions may be deemed to be methods of competition and should not be limited by regulatory authorities.

Finally, barriers to exit can dampen competition. A barrier to exit is something that makes it costly for a firm to exit a market, where the firm would not have prospects for recovering that cost from other firms or customers. Barriers to exist create problems when firms

are hesitant to enter a market because they know that, if they are to fail, they will incur extra costs simply to leave the market.

G. Difficulties with Incomplete Data

An OECD Policy Brief from 1996 indirectly addresses issues of incomplete and inaccurate data and provides insight into potential resolutions to these difficulties. In recommending above all clear definition of principles and standards, the policy brief suggests four tests of effective competition, each of which can be utilized in the absence of high-quality data and statistics. The brief explains that many countries focus on the economic impact that firms' strategic behavior has on consumers and competition. Other countries focus on the type of strategic behavior that occurs to determine anti-competitive behavior. Each approach has its benefits and drawbacks. The policy brief highlights the tension between finding an administratively easy way of monitoring competition, enforcing legal certainty, and ensuring accuracy in results. In order to achieve these goals simultaneously, four tests are recommended: the profit sacrifice test, the no economic sense test, the equally efficient firm test, and consumer welfare balancing tests.

The first two tests referenced are currently the main competing antitrust liability standards governing exclusionary conduct. In brief, the profit sacrifice test states that conduct is illegal if a firm's actions result in an otherwise irrational profit loss. The no economic sense test states that only conduct that makes no economic sense should be considered illegal. A forthcoming article in the *Antitrust Law Journal* (by Salop) argues against both of these methods and in favor of the last test referenced, the consumer welfare balancing tests. These tests require authorities to weight the effects that the conduct has on consumer welfare. Although Salop is a proponent of

the latter, it is clear that measuring the existence and magnitude of such welfare changes would be challenging at best. Finally, the equally efficient firm test would find illegal any competitive action that may exclude a rival that is at least as efficient as the dominant firm it. In short, it is difficult if not impossible to rely solely on one measure of anti-competitive behavior.

IV. Conclusion

In this paper we have reviewed the basic approaches to determining whether a market is competitive. In general there are many approaches and the best practice for one country might not be the best practice for another country because of differences in data availability, institutional practices, and the like.

In general, the first step in determining market power is to define the market. This is done by identifying all of the possible ways that customers might try to avoid paying a price increase for the products in question. If customers cannot avoid the price increase except by simply not purchasing the products in question – in other words, there are no reasonable substitutes available and no suppliers are in a position to create substitutes – then products constitute a market.

The second step is to gauge whether there might be a reason for concern. This is typically done by looking at measures of market concentration, such as the HHI. If the measures are low, for example if the HHI is less than 1000, then most analysts would consider the market to be competitive and no further analysis would be done. If the market appeared to be highly concentrated, this would not be proof that the firm(s) has market power, but rather would indicate that further review needs to be done.

This further review includes examining how the firms are behaving, whether there are structural issues, and the market outcomes. Firm behaviors to be considered include indications that firms are not competing, but rather are strategically interacting. Such indicators include price-cost margins (such as the Lerner Index), market segmentation (in terms of firms choosing to service different markets), and communications among firms. Structural issues include barriers to entry and barriers to exit. Market outcomes include profitability. Profits that persist in being higher than what is typical for the economy might indicate the exercise of market power.

To expand on this last statement, it is important to note that it is the exercise of market power, not the existence of market power that is of concern. When a firm exercises market power, it limits supply, which results in high prices for consumer and a loss of consumption. The exercise of market power might also result in lower quality, higher costs, and less innovation, but the exercise of market power does not necessarily result in these things.

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