Methods for Increasing Competition in Telecommunications Markets

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Abstract

We examine the concepts of workable competition, barriers and conduct that limit the achievement of workable competition, and steps that sector regulators can take to address these obstacles.

The concept of workable competition is an attempt to describe a market situation that does not fit the model of perfect competition, but that has enough features of perfect competition that government intervention is unnecessary and possibly even counterproductive. The first attempt to define workable competition focused on issues of product differentiation, the number and size-distribution of producers, restrictions on output, imperfection in the value chain, information, scale economies, and producer ability to change output. Most recently a simple set of metrics emerged, namely that there should be at least 5 reasonably comparable rivals, none of the firms should have more than a 40 percent market share, and entry by new competitors must be easy.

Barriers to achieving workable competition can be divided into demand side market features, supply side market features, and firm conduct issues. Demand side market features include switching costs, network effects, and lack of customer information. Switching costs discourage customers from changing suppliers. Network effects, if captured by a single firm, make it hard for rivals to offer services of comparable value to that provided by the dominant firm. Limited customer information means that customers have to incur costs even to consider whether to obtain service from a different service provider.

Supply side factors are those market features that make it costly for operators to provide customers with competitive alternatives. These include sunk costs, licensing restrictions, first mover advantages, incumbent control of essential facilities, geographical availability of service,

exclusive rights on specific technologies, exclusive distribution arrangements, access to financial capital, economies of scale or scope, vertical integration, and the presence or absence of actual rivals. In this paper we identify when each market feature hinders competition and when it does not.

In certain instances an operator has an incentive and an opportunity to engage in conduct that harms rivals and potentially customers. We examine anti-competitive cross-subsidization and predatory pricing, firms' use of information obtained from competitors to limit competitive pressures, an incumbent firm's denial to rivals the technical information about essential facilities and other information necessary for those rivals to provide services, firm price fixing, and rivals dividing markets amongst themselves. We illustrate that cross-subsidization and predatory pricing are unlikely to be commercially profitable unless there is a regulatory mechanism that allows the operator to recover costs. We show that the other anti-competitive actions listed may be commercially viable and must be monitored.

We examine a range of remedies for such anti-competitive behavior, from those that seek to decrease market power to those that seek to dampen the effects of market power by directly controlling the firms with market power. Remedies designed to decrease market power include regulation of network interconnection, access to essential facilities, service resale, structural and functional separation, accounting separations, equal access, number portability, and removal of government-imposed barriers to competition. Remedies designed to limit operators' abilities to exploit market power include price cap regulation, price floors, imputation, the net revenue test, and investigations into collusive behavior. Each of these concepts will be analyzed in the body of this paper.

An overarching principle in applying remedies to anti-competitive measures is to ensure that the purpose of the intervention is to move market outcomes closer to competitive outcomes, not to try to improve upon competitive outcomes. Sometimes when regulators try to change outcomes to results more comfortable politically than the results of full competition, they introduce contradictions within the regulatory system, provide opportunities for rent seeking behavior on the part of powerful stakeholders, lower efficiency, and harm customers. These possibilities must be guarded against, as explained below.

I. Introduction

A modern telecommunications infrastructure is an essential element of a modern economy and a modern society. (CSTB, 2006) At its core, economic development serves to enhance the productivity of land, people, capital, and technology. Telecommunications enhances this productivity by enabling the more efficient use of land; allowing people to enhance their skills, expand what they can accomplish in a day's work, and improve their use of teams and flexible organizational arrangements; expanding the availability of capital and decreasing risk by expanding the information that is available to investors; and improving the intelligence, interaction, design and adoption of new technologies. Telecommunications enhances societal development by allowing people to know each other and interact across distances, cultures, and time.

Competition is essential to the development of a modern telecommunications infrastructure. Waverman, Meschi, and Fuss (2005) demonstrated that competition was instrumental for developing mobile telecommunications in both developed and developing countries. Gutiérrez (2003) found that "opening of the market to more competition and the free entry of private investors in basic telecommunications services will propel network expansion and efficiency across the sector" in his study of Latin American telecommunications. Wallsten (2004) found that protecting incumbents from competition resulted in decreased investment in telecommunications networks, fewer payphones, lower mobile telephone penetration, and less international calling. Aron and Burnstein (2003) found that competition between telecommunications companies and cable television companies was the most effective catalyst for increased broadband penetration in the United States. Lee and Marcu (2007) found that

competition had a positive impact on broadband development in both developed and developing countries.

Empirical research confirms that an important role for telecommunications and competition regulators is ensuring that competition is sufficiently intense to enable the desired economic and societal development. (Waverman, Meschi, and Fuss, 2005; Gutiérrez, 2003; Spiller, 2005; Lyon and Li, 2003; Cubbin and Stern, 2006) Hauge and Jamison (2009) describe how regulators determine whether markets are competitive. In the current paper we examine remedies for weak competition in telecommunications markets, with special emphasis on developing economies.

We begin by examining the concept of workable competition. The concept of workable competition developed in an attempt to describe a market situation that did not fit the model of perfect competition, but that had enough features of perfect competition that government intervention was unnecessary and possibly even counterproductive. The first attempt to define workable competition focused on issues of product differentiation, the number and size-distribution of producers, restrictions on output, imperfection in the value chain, the value of information, scale economies, and producer ability to change output. Most recently a simple set of metrics emerged, namely that there should be at least 5 reasonably comparable rivals, none of the firms should have more than a 40 percent market share, and entry by new competitors must be easy.

We then study barriers to achieving workable competition. These barriers can be divided into demand side market features, supply side market features, and conduct issues. Demand side market features include switching costs, network effects, and lack of customer information. Switching costs discourage customers from changing suppliers. Network effects, if captured by a

single firm, make it hard for rivals to offer services of comparable value to those offered by the dominant firm. Limited customer information means that customers have to incur costs even to consider whether to obtain service from a different service provider.

Supply side factors are those market features that make it costly for operators to provide customers with competitive alternatives. These include sunk costs, licensing restrictions, first mover advantages, incumbent control of essential facilities, geographical availability of service, exclusive rights on specific technologies, exclusive distribution arrangements, access to financial capital, economies of scale or scope, vertical integration, and the presence or absence of actual rivals. We identify when each market feature hinders competition and when it does not.

We also examine anti-competitive cross-subsidization and predatory pricing, firm's use of information obtained from competitors to limit competitive pressures, firms' denying rivals access to the technical information about essential facilities and other information necessary in a timely manner that enables them to provide services, firm price fixing, and rivals dividing markets amongst themselves. We find that cross-subsidization and predatory pricing are unlikely to make sense on a commercial basis unless there is a regulatory mechanism that allows the operator to recover costs, such as rate of return regulation.

We then study a range of remedies of anti-competitive behavior from those that seek to decrease market power to those that seek to dampen the effects of market power by directly controlling the firms with market power. Remedies designed to decrease market power include regulation of network interconnection, access to essential facilities, service resale, structural and functional separation, accounting separations, equal access, number portability, and removal of government-imposed barriers to open competition. Remedies designed to limit operators'

abilities to exploit market power include price cap regulation, price floors, imputation, the net revenue test, and investigations into collusive behavior.

The remainder of this paper is organized as follows. The next section reviews the concept of workable competition and barriers to achieving workable competition. Section III examines remedies. Section IV is the conclusion.

II. Factors Leading to Market Power

In this section we examine the factors that lead to market power. We begin by reviewing the concept of effective competition. We then divide factors leading to market power into demand side influences, supply side factors, and conduct issues. Demand side influences are market features that make it hard or costly for customers to change suppliers, even if multiple suppliers are willing and able to provide the customers with a product and pricing arrangement that would make customers better off than the product or service the customers' existing supplier(s) provides, all other things being equal. Supply side factors are those market features that make it hard or costly for operators to provide customers with competitive alternatives. Conduct issues are actions that result in suppliers choosing to not compete with each other.

A. Defining Effective Competition

It is common to discuss problems with market power in terms of loss of net consumer surplus, which is the value that consumers receive from consumption over and above what consumers have to pay. A focus on consumer surplus is insufficient for infrastructure industries, such as telecommunications, because of the vital roles that they play in our economies. Infrastructure industries are imbued with the public interest in that the welfare of the rest of the

economy is dependent on their success. Glaeser (1927, p. 171) explains what economies need from their infrastructure sectors, namely the sectors should be: (1) technically efficient, meaning that the sectors should operate at least-cost for the desired quality, output, and innovation;[1] (2) efficient in how they affect the allocation of the resources in the economy, meaning that profits should not consistently exceed (or be below) the level that is needed to ensure continued financing of the operations and infrastructure, and that service prices should reflect marginal costs;[2] and (3) dynamically efficient, meaning that the sector should provide new services and innovations when customers are willing to pay compensatory prices for the new services.

Most infrastructure sectors are non-competitive by nature and so are regulated as natural monopolies. Telecommunications is an exception in that the markets can be effectively competitive, meaning that they can achieve a level of competition sufficient to achieve Glaeser's criteria. But what is meant by effectively competitive? Several authors have written on the topic.

One of the earliest attempts at a definition of effective competition was that of Clark (1940). Pointing out that the concept of perfect competition was not practical, Clark explained that factors could be identified that, when they are present, sufficiently approximate the assumptions of perfect competition so that the market should be considered workably competitive. Clark's factors, many of which are now incorporated into current SSNIP tests[3] (Hauge and Jamison, 2009) and the Hirschman-Herfindahl Index (HHI),[4] included:

[1] This is the concept of X-efficiency, which addresses the issue of operating at least cost. Some managers are less vigilant than others about keeping costs as low as possible. X-inefficiency occurs when employees do not work at maximum levels, and when inputs are wasted. (Leibenstein, 1966)

[2] The change in volume-sensitive costs resulting from a small change in output is called marginal cost (Kahn, 1988, I p. 65-66). Firms have two basic categories of costs: fixed costs and volume sensitive costs. (Jamison, 2006) Fixed costs are those that do not vary with the level of output. All costs that are not fixed are by definition volume-sensitive costs (Jamison, 1999, p. 22). A firm is said to be maximizing its profits when it chooses an output level that equates marginal revenue and marginal cost (Brown and Sibley, 1986, p. 13).

[3] SSNIP stands for small but significant and non-transitory increase in price.

[4] He later changed "workably competitive" to "effectively competitive." (Sosnik, 1968)

- The degree of product differentiation. In effect this factor determines the degree to which consumers would consider whether there are reasonable substitutes for the product in question. This is considered in SSNIP tests.

- The number and size-distribution of producers. Today this is typically measured by the HHI, but other measures, such as four-firm concentration ratios also are used.

- Restrictions on outputs. Clark described restrictions in terms of how prices are determined, but the essence of his analysis was whether firms restricted output or sold whatever customers would buy at the prevailing price. This is measured by examining industry profits and the Lerner index, which is a measure of the degree to which prices deviate from marginal costs.

- The general method of selling, such as through exclusive agents, at stores, and the like. The effects of the method of selling are indirectly measured by firm profits and the Lerner index.

- The information in the market, such as whether consumers are well informed, whether rivals know what each other are doing, and the like.

- The degree of short run and long run scale economies.

- Producers' abilities to adjust output to changing market demands.

Criticizing the attempts to define effective competition, Stigler (1956) said that the main criteria – adequate number of rivals, free entry, absence of collusion, and absence of persistent price discrimination – were simply restatements of parts of the theory of perfect competition and that the remaining factors were ambiguous symptoms of monopoly or hypotheses on market conduct that relied upon monopoly theory. But Stigler's criticisms addressed whether effective competition is a theoretical market structure distinct from ideas of perfect competition, monopolistic competition, oligopoly, and monopoly. Clark (1940) was clear that he was not attempting to define a new market structure, but rather to identify factors that if present would imply that the market was close to the perfect competition model.

In an attempt to add rigor to the effective competition concept, Sosnik (1968) outlined a set of principles for choosing criteria for defining effective competition and concluded that an effectively competitive market would be free from:[5]

- Unsatisfactory product quality, suppression of new products, and incomplete standardization
- Over or under production because prices deviate from marginal cost
- Inefficient market processes, caused by restricting buyer access to less costly alternatives, unnecessarily large transaction costs, and restrictions on price competition
- Inefficient production caused by poor business locations, outdated techniques, unexploited economies of scale or integration, and X-inefficiency[6]
- Negative externalities, which occur when people not involved in an economic exchange are nevertheless negatively affected by the exchange
- Loss of rivalry because of malicious interference with competitors or fraud against customers or suppliers, predatory activities against rivals, foreclosure of rivals, refusals to deal, and collusion
- Discrimination among customers not justified by differences in demand or costs
- Excessive entry resulting in operators not achieving economies of scale or excessive price competition that causes revenues to be inadequate to finance investment and innovation

Most recently, Shepherd (2004) argued that for a high probability of consumer benefits, a market should be characterized by:

1. At least 5 "reasonably comparable" rivals, although the number may vary slightly across situations.

[5] Sosnik identified 25 flaws that should not be present in effectively competitive markets. We have combined and edited them into the list we present here.

[6] Economies of scale exist when a proportionate increase in the level of inputs results in an increase in the productivity of the inputs (Mas-Colell, Whinston, and Green, 1995, p. 132). In regulation economies of scale are said to exist in situations where average costs decline with increases in output (Kahn, 1988, I p. 124). Economy of scale is one of four forms of production economies. Economies of scope are another form of production economies. Scope economies exist when it is less expensive for a single company to produce two or more products than for two or more companies to produce them (Panzar and Willig, 1981). Economies of vertical integration are present if it is less expensive for a single company to produce both an input and the final product than to produce the two separately. Lastly, there are economies of density, which exist when customers are sufficiently close to each other to make their marginal costs lower than the marginal cost of the average customer. (Jamison, 2006)

2. No firms holding a dominant position (i.e., with 40% of the market or more).

3. Easy entry by new competitors.

He described these as criteria for effective competition and discouraged practitioners from considering topics of contestability.[7]

The Hong Kong Office of Telecommunications Authority (OFTA) applied concepts of effective competition when deciding what factors it would consider in identifying market dominance (Kim, 2003). More specifically, its examination of market dominance considered the following:

- market share of the operator;
- the operator's ability to influence prices and other market outcomes;
- barriers to entry to competitors;
- the degree of product differentiation and sale promotion; and
- other factors that OFTA may choose in consultation with the operators

In summary, while there has been considerable debate over the years as to the usefulness of theoretical models of competition that are too abstract to apply in practice, economists and others have found only limited agreement on more practical approaches. The areas of agreement tend to be that markets must be carefully defined in terms of product differentiation and geographic boundaries; and, that effective competition should be evidenced by the presence of multiple firms of similar size, ease of entry, and ease of consumers to change suppliers.

[7] A contestable market is one in which entry is absolutely free, meaning that the entrant faces no disadvantage relative to the incumbent, and exit is absolutely costless. A crucial feature of a contestable market is that it is subject to hit-and-run entry, meaning that the entrant can enter a market, extract profits, and leave before the incumbent can react. Contestable market theory is an interesting theoretical construct and provides insights into cost structures for multiproduct firms, but in practice there are no contestable markets. (Baumol, 1982; Jamison, 1999, pp. 19-23.)

B. Demand Side Features

As we described above, demand side influences are market features that make it hard or costly for customers to change suppliers, even if multiple suppliers are willing and able to provide the customers with a product and pricing arrangement that would make the customer better off than what the customer's existing supplier provides, all other things being equal. These features include switching costs, network effects, and lack of customer information. We address each of these in turn.

1. Switching Costs

Switching costs are costs that a customer or an alternate supplier must incur for a customer to change suppliers, but that do not have to be incurred either by the customer or the incumbent supplier, if the customer does not switch suppliers. Consider for example a situation where a computer user has created documents using Microsoft Word and the customer is thinking about switching to using WordPerfect for word processing. To change software, the customer would need to learn the new software and make sure that WordPerfect correctly converts a document created with Microsoft Word whenever she wants to revise it.

Switching costs decrease the intensity of competition. To illustrate, consider a situation where two operators, *A* and *B*, compete in a market. Further assume that operator *A* has a first mover advantage in the sense that it was able to obtain a customer base before *B* entered the market. To simplify the analysis, assume that customers place the same value on the two operators' services and that each operator's costs for providing service to a customer are the same as the other operator's costs would be to serve the customer. If operator *A* charges a price P_A for its service, then *B* can charge no more than $P_B \leq P_A - s$, where s is the switching cost that

the customer incurs if he changes from purchasing from *A* to purchasing from *B*. From this we can see that switching costs diminish operator *B*'s incentive to enter the market, or if it enters, its incentive to take customers from *A*, because *B*'s profits will be lower than *A*'s profits by the amount *s* per customer that *B* takes from *A*. We also can see that if *A*'s initial market share is sufficiently large that *B* must take customers from *A* to be financially viable, then *A* can maintain a monopoly in the market by charging a price $P_A \leq s + c$, where *c* is the uniform cost of serving a customer.[8]

Notice that switching costs limit competitive pressure even if neither operator has an advantage of an initial customer base. Even if operators have equal market shares, each is able to maintain a price that is higher than its rivals' quality-adjusted prices[9] by the amount s, which results in higher overall prices in the market.

2. Network Effects

Network effects occur when the value of a service to an individual customer depends on the number of other customers who use the service. For example, assume that a network provider introduces a new method of texting that is incompatible with all other texting technologies. How much would a potential customer be willing to pay for the new texting technology if the potential customer thought that no other customers would also buy it? The answer is, "Nothing," because texting is of no value if there is no one to send text messages to and no one to receive text messages from. But now change the scenario. Would a potential customer be willing to pay for a new texting technology if the potential customer thought 1000 other customers would buy the new service than if she thought only 5 other customers would buy it? The answer is, "Yes,"

[8] We simplify our analysis by assuming that *c* is constant and is the same for *A* and *B*.
[9] A quality adjusted price is one whose nominal value is changed to reflect the quality of the product relative to the qualities of substitute products.

because the potential customer can do more texting if there are 1000 other text customers than if there are only 5 other customers. Both of these scenarios illustrate network effects because the value of the service depends on the number of customers.

There are two basic kinds of network effects. Direct network effects (exemplified in the above example) are the simplest and occur when an increase in usage directly leads to an increase in the value of the service. The second kind are indirect network effects, which occur when an increase in usage of the service leads to the production of valuable complementary services. An example of an indirect network effect is the iPhone made by Apple where an increase in the number of devices sold increases the incentive of third party developers to create software applications that can be used on the iPhone. The resulting additional available software increases the value of owning an iPhone.

Network effects can affect market competition by causing the market to take on the characteristics of a winner takes all (or nearly all) market. A service that is characterized by network effects must reach a critical mass to be viable. This initial critical mass occurs when the number of customers is sufficiently large to make the service valuable enough to be financially viable. For example, consider the example market in Table 1. There are ten potential customers in the market. The first column in Table 1 shows the demand level. For example, the fifth row represents the situation where five customers buy the network service. The second row shows the value the marginal customer places on each other customer purchasing the service. For example, when five customers buy the service, the fifth customer (called the marginal customer) places a value of 12 on each of the other customers purchasing the service. The last column shows the marginal customer's willingness to pay for the service, which is simply the marginal value times the number of other customers purchasing the service. For example, when five customers

purchase the service, the fifth customer is willing to pay 48 for the service; the customer places a value of 12 on each of the other four customers.

Now suppose that the cost of serving each customer was 32. This means that if the service provider cannot convince at least 3 customers to buy the service, the value of the service will be too low for the provider to be able to charge a price of at least 32 and break even. This low breakeven level is the initial critical mass.

Table 1. Example of Demand with Network Effects

Number of Customers	Marginal Customer	
	Marginal Value	Willingness to Pay
1	20	0
2	18	18
3	16	32
4	14	42
5	12	48
6	10	50
7	8	48
8	6	42
9	4	32
10	2	18

Notice that once initial critical mass is reached, if it is reached, additional customers increase the marginal customer's willingness to pay until at least six customers buy the service, beyond which the marginal customer's willingness to pay declines. This decline occurs because the next customer added is the new marginal customer and he or she values communications less than do the customers who are already buying the service. The consequence of this inverted U-shaped demand curve is that the market takes on a life of its own: demand growth leads to more demand growth. This is called a tipping effect because the market "tips" and expands on its own. The limit of the tipping effect in the above example is nine customers because that is where the

willingness to pay is again equal to the cost of serving a customer. This level is called the second critical mass because it is uneconomical to try to serve more than this number of customers.

Our example illustrates why network effects are important for competition. Suppose that the first operator to enter the market reaches critical mass with its service and the market tips. The operator's profit maximizing level of output is to serve seven customers. At this level the operator charges a price of 48, receives revenue of 336, incurs costs of 224 (7 times 32), and receives a profit of 112. If the operator were to choose to serve six customers, it would receive only 108 in profit and if it chose to serve eight customers it would just break even. Now consider what would happen if a second operator chose to enter the market. Only the customers who value the service very little are unserved by the first operator, so the most revenue that the second operator can receive from these customers is 4.[10] This level of revenue is always less than the new operator's total cost, so the operator chooses to not enter the market. Because the tipping effects lead to one service provider serving all or nearly all of the effective demand, the market is called a winner takes all (or nearly all) market.

Notice two things about this market. One is that the first operator becomes a monopoly without any intention on its part of becoming a monopoly. This is simply the way the demand works. Secondly notice that we assumed that the two operators' services did not "interconnect." If interconnection had occurred, which would lead the services to share network effects, then competition in the market would have been possible.

[10] Serving the 8th customer provides no revenue because this would be the only person buying the newcomer's service, which means the willingness to pay would be zero. Serving the 8th and 9th customers would provide revenue of 4 because the marginal value is 4 and there is only one other customer besides the 9th customer. Likewise, if the operator served customers 8, 9 and 10, the marginal value is 2, but there would be only 2 other customers for the 10th customer to consider when deciding his willingness to pay.

3. Lack of Customer Information

Sometimes customers lack sufficient information to make proper purchasing decisions. Consider for example an announcement by Time Warner in the United States in 2008 that the company would begin pricing broadband access on a gigabyte basis. More specifically, the company planned to charge $29.95 per month for 768 kilobyte per second access, with a cap of 5 gigabytes per month, and $54.90 per month for 15 megabyte per second access, with a cap of 40 gigabytes per month. Customers who go over their gigabyte caps would pay $1 per gigabyte for their usage over their caps. Broadband users rarely know their gigabyte usage and so would have difficulty predicting their monthly bills. To remedy this, Time Warner indicated that it would provide meters so that customers can monitor their usage. But the meter only helps the customer after she has made the decision to purchase the service. It does not help her know beforehand whether she should purchase from Time Warner or from someone else. Research out of Australia indicates that customer uncertainty about their broadband needs and usage has slowed broadband adoption. (Adams, 2008)

Not only might the customer not know whether her usage might exceed Time Warner's threshold, she might also face a tradeoff between a measured service and bandwidth. Table 2 illustrates a pricing choice a broadband customer might face. In this scenario, the customer would need to consider whether she is better off as a low bandwidth subscriber or a high bandwidth subscriber. DSL for low bandwidth is less expensive than the cable modem option, so she would probably choose DSL if she preferred low bandwidth. DSL also is less expensive if she thinks she is a high bandwidth customer; however, her choice is more complicated. The less expensive option (DSL) has a lower bandwidth than the cable modem, but it is also unmetered. Further complicating matters, the customer does not know whether the bandwidths advertised

will be the real network performance. Congestion may occur in one of the networks more frequently than in the other, which would lower the bandwidth she would actually experience.

Table 2. Pricing Plans for Operators *A* and *B*

	Prices	
Operator	***Cable Modem***	***DSL***
Low bandwidth plan	$29.95 per month + $1 per gigabtye for all usage above 5 gigabytes per month	$19.95 per month
High bandwidth plan	$54.90 per month (15 Mbps) + $1 per gigabtye for all usage above 40 gigabytes per month	$42.95 per month (6 Mbps)

The above example illustrates two customer information issues: usage and service quality. Both require actual experience to be known. With respect to usage, the customer needs to know her own usage. But in the case of service quality, she could learn from other customers' experiences if they were made public. Learning from other customers' experiences could also apply to customer service issues, network availability, bill quality or accuracy, and the like.

C. Supply Side Features

Supply side factors are those market features that make it costly for operators to provide customers with competitive alternatives. These include sunk costs, licensing restrictions, first mover advantages, control of essential facilities, geographical availability of service, exclusive rights on specific technologies, exclusive distribution arrangements, access to financial capital, economies of scale or scope (including those of a service provider's own operations and those resulting from joint ventures or other business relationships.), vertical integration (in an operator's own operations and through joint ventures or other business relationships), and presence or absence of actual rivals. In some instances, market growth or the presence of unmet

demand can help resolve the supply side limitation. For example a local fixed line often is considered an essential facility and subject to unbundling requirements. But if market demand is growing rapidly, or if there is a shortage of fixed lines, then it is possible that rival operators may have equal opportunities to build the lines that will be used to meet the unmet or new demand. In this section, we address each supply side issue.

1. Sunk Costs

A sunk cost is the cost of a production activity that is so specialized that it cannot be easily converted to another purpose (Sharkey, 1982, p. 37). For example, an operator that obtains a license to provide wireless service may find that it cannot reverse the license costs by being reimbursed by the government or selling the license to someone else. The unrecoverable portion of the license cost would be a sunk cost. Sunk costs serve as a barrier to entry. To illustrate, consider a situation where a firm can choose to enter either market *X* or market *Y*, but not both. To focus our attention on sunk costs, we assume that both markets have some risk or uncertainty about future profits, but the expectations are the same for both markets. We also assume that before entering a market the firm knows that profits could be $5 million with probability ρ and could be a negative $2 million with probability 1-ρ. Because ρ is a probability, it is no less than 0 and no greater than 1.

We further assume that the government charges a $1 million license fee for either market, but has different rules for the two markets. For market *X* the license fee is a sunk cost, i.e., the government charges the $1 million license fee before entry and will not reimburse the fee nor let the operator sell its license to another operator. For market *Y* the license fee is not a sunk cost,

i.e., the government charges the fee only if the operator stays in the market once the operator knows its expected profit and has decided whether to stay in the market.

Now compare how the operator views entering the two markets. In market *X*, the operator's expected profit is (ρ * \$5,000,000) - (1-ρ) * \$2,000,000) – \$1,000,000. Expected profit is non-negative (i.e., the operator expects to at least break even) as long as $\rho \geq 3/7$. For market *Y*, the operator's expected profit is ρ * (\$5,000,000 – \$1,000,000) - (1-ρ) * \$2,000,000). Expected profit is non-negative as long as $\rho \geq 1/3$. To see if the expected profit for market *Y* is always greater than the expected profit for market *X*, we subtract the former from the latter and obtain (1 – ρ) * \$1,000,000, which is always positive for values of ρ between zero and one, so the firm always chooses the market non-sunk cost market *Y* over sunk cost market *X*.

Another form of sunk cost is monies that have not been spent, but that will be spent even if the company goes out of business. An example would be termination clauses on contracts. These types of sunk costs also are barriers to entry.

Sometimes the term sunk cost is used differently than how we use it in this paper. For example, sometimes embedded costs (monies already spent by a firm) are called sunk costs. But these embedded costs do not create barriers to entry, so they are not a concern for our analysis.

2. Licensing Restrictions

Conditions on operator licenses can limit operators' ability to provide competition to other operators. Recall from Hauge and Jamison (2009) that greater substitutability between products increases the intensity of competition, as does the ease with which a potential rival can create a substitute product. Licensing restrictions that limit what an operator can provide limits competition. Consider for example the various forms of licenses listed in the ICT Regulation

Handbook:[11] International Services Authorizations, Mobile Cellular Telecommunications, 3G Wireless Services, Rural Service Licenses, Satellite Services, VSAT Services, WLAN, LAN, Paging Services, Public Payphone, Fixed Wireless Access, and PSTN. If a country were to use all of these different forms of licenses, an operator with a mobile cellular license might not be allowed to provide competition for 3G licensees even if the mobile operator had a technology that could provide 3G services with the operator's existing radio spectrum. Similarly the mobile operator might not be allowed to place payphone-like devices using the mobile radio spectrum.

Contrast this with the licensing policy of Guatemala, which simply says that any person can provide telecommunications service to any other person at anytime and anywhere in the country. All a person has to do to obtain a license is ask. This allows operators to create services based solely on cost and demand considerations, and not on license design.

3. First Mover Advantages

In certain markets it may be advantageous to establish an early presence in a market, such as being an incumbent. This generates what often are called first mover advantages. A firm that is early in the market can establish a customer base, which increases the firm's likelihood of surviving a price war that might ensue following the entrance of rivals. (Shapiro and Varian, 1999, pp. 29-32) To illustrate, consider a market where each firm incurs annually $1 million in fixed costs and zero marginal costs, regardless of how much service is sold. Now assume that the incumbent is selling 1 million units annually when a potential entrant is making its entry decision. The incumbent's average cost is $1, so it can receive a positive profit if it can charge more than $1. Suppose the potential entrant knows that it would sell only 250,000 items its first year, making its average cost $4. If the entrant and incumbent were to engage in a price war, the

[11] See http://www.ictregulationtoolkit.org/en/Section.697.html. (downloaded July 7, 2008.)

entrant would lose money if the price fell below $4, but the incumbent would continue to receive a positive profit as long as the price stayed above $1. This means that the incumbent is more likely to survive a price war. This first mover advantage may actually discourage entering rivals from starting a price war, since they are likely to lose.

Another first mover advantage is the opportunity to secure scarce resources. For example there may be limited building access for fiber optics or limited antenna sites for wireless networks. An incumbent has an opportunity to in some sense lock up these resources, or at least put rivals at a cost disadvantage when they try to secure access to these resources. This disadvantage could be caused by, for example, delaying access through regulatory or legal proceedings, or through lengthy contract negotiations. An incumbent might also enjoy greater name recognition than its rivals, established relationships with suppliers and marketing channels, and a unique opportunity to establish long term contracts with profitable customers.

Lieberman and Montgomery (1988) point out three additional advantages to being an incumbent. One is technological leadership, which might result from learning by doing where the incumbent learns through its experiences and new entrants are unable to acquire that learning by observing the incumbent, hiring away key employees, reviewing publications or other documentation from the incumbent, or reverse engineering the incumbent's products. As might be clear from this list of caveats, it is difficult for an incumbent to acquire and sustain technological leadership. The second advantage they point out is the opportunity to impose switching costs on customers. The third advantage is that buyers have to incur the cost of learning about new entrants before purchasing from them.[12] Some customers will not wish to incur these costs because of the uncertainty that buying from the entrants will be worth the cost of investigation.

[12] This is related to the demand side issue of whether customers have adequate information.

There also are drawbacks to being an incumbent. An incumbent might have a cost disadvantage because newer entrants can more easily adopt more efficient technologies. Also, entrants can learn from the incumbent's mistakes and do not have to overcome the reputation for having made the mistakes.

4. Control of Essential Facilities

Developed in a legal case between MCI and AT&T in the United States,[13] the essential facilities doctrine is a four-part test to determine whether a vertically integrated operator should be required to sell an input to rivals. The four parts of the test are:

1) Is the vertically integrated operator a monopolist in control of the essential facility?
2) Is the rival unable practically or reasonably to duplicate the essential facility?
3) Does the vertically integrated operator deny use of the facility to the rival?
4) Is it feasible for the vertically integrated operator to provide access to the rival?

A WTO reference paper on telecommunications defined essential facilities as "facilities of a public telecommunications transport network or service that: (a) are exclusively or predominantly provided by a single or limited number of suppliers; and (b) cannot feasibly be economically or technically substituted in order to provide a service."[14] A recent Supreme Court case in the U.S. – Verizon Communications, Inc. v. Law Offices of Curtis V. Trinko[15] – effectively added a fifth part to the test, namely, is there regulatory oversight by an agency that could force access? (Blair and Piette, 2005) The doctrine is essentially a "refusal to deal" issue

[13] *MCI Communications Corp. v. American Telephone & Telegraph Co*. 708 F.2d 1081 (7th Cir. 1983).
[14] World Trade Organization, April 24, 1996. http://www.wto.org/english/tratop_e/serv_e/telecom_e/tel23_e.htm, downloaded July 7, 2008.
[15] 124 S. Ct. 872 (2004).

that, although developed in the U.S. courts, has been adopted by the U.K., the E.U., and South Africa.[16] That the owner of the essential facility must possess market power before being required to provide access is implicit in the idea that the facility is essential for providing the service in question and that the facility cannot be practically or reasonably duplicated. (Hausman and Sidak, 1999)

Essential facility issues can arise in several instances in telecommunications. Examples include local fixed line loops, building access, mobile network towers, and telephone numbers. For example, the telecommunications regulator in the U.K, OFTEL, transferred responsibility for administration of telephone numbers from the incumbent operator, BT, to itself, and required the adoption of number portability, which allows customers to keep their phone numbers when changing telecommunications suppliers. In this instance the essential facility was deemed to be the telephone numbers.

5. Geographical Availability of Service

In this section we consider how geographic availability of service affects market power. We begin by considering how to define markets geographically. We then discuss how to consider whether operators outside of a geographic area can provide competitive pressure within the area.

Tests for significant market power define markets along product lines and along geographic lines. (Hauge and Jamison, 2009) Regarding geography, the market boundary is identified using the hypothetical monopolist test, which identifies a geographic region "where a hypothetical monopolist that was the only present or future producer of the relevant product in

[16] Pitofsky (undated) and the Competition Commission of South Africa, http://www.compcom.co.za/resources/september2002/pages/04_facilities.htm, downloaded July 8, 2008.

that region would profitably impose at least a 'small but significant and nontransitory' increase in price (SSNIP)."[17] This becomes a question of how far a customer would move in response to a SSNIP and the answer is generally that the customer would not move. This leads to the conclusion that every customer is its own geographic market. But treating each customer as a market is unnecessary for reaching meaningful conclusions about market power, and it overly complicates the analysis because only in rare instances can an operator develop individual customer prices. More generally the operator establishes prices that apply to broad geographic areas. As a result we believe that a geographic market should be no smaller than the geographic area within which, as a practical matter, operators would not segment customers geographically for setting prices or output.

For example, suppose that a fixed line broadband provider serves an entire city, such as Bangkok, and faces no competition. In defining the geographic market, the analyst would ask the question: Can an operator practically charge different prices in different areas of the city, and can an operator practically limit its service to only some parts of the city?[18] Let's assume for purposes of our example that the answer is "no." Then it is appropriate to consider the entire city as the relevant geographic market.

Now consider a second scenario: Assume that there is one rival in Bangkok and that this rival serves only the Ratchathewi district. Now the analyst asks the same question about whether an operator can charge different prices in the one district. In this second scenario the answer is, "Yes, there is an operator that does serve only one district and so can price specifically for that district even though the initial operator cannot do this." This leads the analyst to conclude that

[17] Donald Stockdale presentation at the 24th PURC/World Bank International Training Program on Utility Regulation and Strategy, Gainesville, Florida, June 2008.

[18] Notice that we do not need to consider whether the geographic market is larger than Bangkok because we have already established that the operator was able to serve Bangkok without serving other areas of the country.

the Ratchathewi district is a separate geographic market. Now the analyst asks: Can an operator practically charge different prices in non-Ratchathewi areas of the city, and can an operator practically limit its service to only some parts of the city outside the Ratchathewi district? Since there are no operators doing this and the initial operator is unable to segment its customers at any geographic level smaller than the city level, we can conclude that the answer to the analyst's question is "no." But this leaves the question: How should the analyst conduct the test for market power? In the case of the Ratchathewi district, the test for market power should apply only to that district since a price change there can be limited just to that district. However, given our assumption than an operator serving the rest of Bangkok cannot limit price changes to just the districts other than Ratchathewi, the market power test for the rest of Bangkok should consider how competition in Ratchathewi affects the initial operator's ability to raise prices outside of Ratchathewi.

Now consider our second issue for this section, namely how a rival outside a geographic area might provide competitive pressure inside the area. This is a question of entry. If an operator outside an area can easily enter the area in response to a price increase, then the operator provides competitive pressure. To illustrate this point, consider a third scenario and assume that there is an incumbent serving Bangkok who cannot segment the market at a more granular level than the entire city. Also assume that a rival serves only Ratchathewi, but that the rival can expand into other parts of the city. Now when the analyst examines whether the incumbent can profitably raise its price, the analyst considers not only the loss of market share in Ratchathewi that the incumbent would suffer, but also the loss of market share in whatever other districts the rival might enter.

6. Exclusive Rights on Specific Technologies

In certain instances exclusive or restrictive rights to specific technologies can lead to monopoly or at least to market power. (Blair and Kaserman, 1985, p. 96) In some countries such exclusive rights are allowed under the theory that the prospect of monopoly profit stimulates invention. There is some empirical support for this theory, but it would be a mistake to apply the theory to situations where the exclusive right is not linked to invention, such as would be the case for technologies that are imported rather than created in the country. To illustrate, consider a situation where a regulator never allows exclusive rights to a technology. A mobile provider considering whether it should try to create a new method for decreasing radio interference would factor into its analysis the extent to which its rivals could adopt the new technology once it was created. Given that the new technology could not be legally protected, the mobile provider would probably conclude that its rivals could quickly adopt the new technology once it was created (perhaps by reverse engineering some equipment, hiring employees that know the technology, or some other means). This would lead to the further conclusion that the mobile provider's benefits from innovation would be quite limited and so the mobile provider would not invest heavily in trying to invent such a technology. This is a situation in which exclusive rights to a technology might be desirable.

Now consider a country that allows exclusive rights to inventions and to imported technologies. This policy actually lowers the incentive to innovate. When it considers how to invest in improved technologies, our mobile operator in this situation chooses between importing a known technology or investing in invention of another technology. Both approaches result in profits from the exclusive rights to the technology chosen, but invention is clearly more costly

and more risky than importing. As a result the operator would choose to import the known technology.

Contrast this with what would happen if the country limited exclusivity on technologies to inventions. Now all mobile operators would adopt the imported technology, resulting in benefits for all customers and no supernormal profits for any of the operators.[19] Not only this, but operators would have an incentive to attempt to invent also, since inventions could still provide a competitive advantage.

Exclusive rights to technologies not invented by the service provider, either directly or through funding of research by a supplier such as a software provider, are essentially exclusive dealing arrangements, which we discuss below. (Blair and Kaserman, 1985, pp. 408-424) There are reasons why a supplier might find it attractive to provide exclusive rights to one operator. The supplier might believe that exclusive rights will improve promotion of the technology, increase the chances of adoption by decreasing risk for the operator, or make the operator willing to pay a premium for the technology because the operator expects to receive supernormal profits. The downside from a policy perspective is that exclusive rights might result in market foreclosure. There appear to be three necessary conditions for foreclosure to result from exclusive technology rights.[20] First, the technology must confer a substantial amount of market power on the operator. Second, a substitute technology must not be readily available from an alternative supplier. Third, the contract period must be longer than would be the operator's normal practice. If all three of these conditions are not present, then it is unlikely that the exclusive arrangement will result in foreclosure.

[19] The incentive for adoption is that any firm that did not adopt a beneficial technology would be at a quality or cost disadvantage to its rivals, which makes adopting the technology a necessary condition for receiving normal profits.
[20] These three conditions are adapted from Blair and Kaserman (1985, pp. 416-417). The Blair and Kaserman conditions apply to exclusionary effects of exclusive distribution arrangements that limit suppliers' options for distributing their products.

7. Exclusive Distribution Arrangements

An exclusive distributor arrangement occurs when an operator and distributor agree that the distributor will deal exclusively with the operator for certain services. Such agreements foreclose the operator's rivals from accessing the marketplace through that distributor. These are called vertical non-price restrictions because the agreement is between non-competitors. (Blair and Kaserman, 1985, pp. 408-424)

Reasons justifying exclusive distribution arrangements are similar to those for exclusive technology agreements. One reason is that the distributors may believe that it is less costly for them to deal with a single operator than with multiple operators. Also, the operator may be more willing to engage in training for the distributors if the operator knows that the training will not be used to sell rivals' products.

Exclusive distributorship agreements are not *per se* illegal in countries such as the United States, but they may violate antitrust laws if their effect is to substantially lessen competition between operators or tend to create a monopoly. Determining whether the arrangements are illegal requires an analysis of several factors, including:

- The operator's ability (through market power) to unreasonably restrain trade in the relevant market;
- The effects of the restrictions on competition between operators; and
- The justification for imposing the restrictions.[21]

[21] Keeley, Kuenn & Reid, http://www.kkrlaw.com/changes/exclusive.htm, downloaded July 16, 2008.

8. Access to Financial Capital

Situations can arise where limited access to financial capital can limit competition. In some instances the limited access may simply result from riskiness of the business. For example, investors and lenders may be available, but view an operator's business plan or business situation to be too risky for providing capital. Or the investors and lenders might provide capital only at a high cost, which results in high investment costs, operating costs, or both for the operator. In either instance the restriction limits market entry or market competition, but the problem is not with the capital market, but with the telecommunications market or with the operator. (Smith, 1971)

In other instances, limited access to capital might result from imperfections in the capital markets. For example, rivals may have difficulty being listed on stock exchanges or stock exchanges may not exist in the country. Such a lack of an efficient market for capital may put the rivals at a cost disadvantage relative to more established firms.

Finally, the limited capital may result from anticompetitive conduct. This occurred in early development of telecommunications in the United States. At the time that AT&T was competing with newly formed independent telephone companies for franchises to provide service in some major cities, AT&T's financial backer, JP Morgan, used his connections in the financial community to limit the independent companies' access to capital, thus allowing AT&T to capture key exclusive franchises and stifle future competition from the independent companies. (Gabel, 1994)

9. Economies of Scale or Scope

Frequently there are economies of production that occur from producing more than one unit of a product, producing more than one unit in a particular location, or producing more than one kind of product. These are called production economies and they fall into four categories. The first is economies of scale. Technically economies of scale exist when a proportionate increase in the level of inputs results in an increase in the productivity of the inputs (Mas-Colell, Whinston, and Green, 1995, p. 132). More commonly economies of scale are said to exist when average costs decline with increases in output (Kahn, 1988, I p. 124). Economies of scale are important in the consideration of market structure because if they are pervasive and the firm produces a single product, then the firm might be considered a natural monopoly because it might be less costly for a single firm to serve the entire market demand than for multiple firms to do so. Scale economies are also important because, even if they do not exist over the entire range of market demand, they may be sufficiently large that a firm must achieve a large size before it is economically viable. As we explain in section II D – Conduct Issues, this can be a barrier to entry.

Another type of production economy is economies of scope, which exist when it is less expensive for a single company to produce two or more products than for two or more companies to produce them (Panzar and Willig, 1981). Scope economies arise because of shared costs, which are costs of resources that, once incurred to produce one product, can be used to produce another product without increasing these particular costs (Jamison, 1999, pp. 19, 21-22). For example, the cost of burying fiber optics might be the same whether the fiber is used only for voice telephone service or if it is used for both voice telephone service and for Internet. The Internet service might affect the technology or capacity costs of the cable, but the burying cost

may be unaffected by either service, which makes the burying cost a shared cost. Economies of scope are important to market structure because they can lead to a multiproduct natural monopoly. However in telecommunications it is more likely that scope economies lead firms to offer a variety of products and make it economical for existing firms to frequently change product quality and introduce new services.

A third production economy is economies of vertical integration, which exist if it is less costly for a single company to produce both an input and the final product than to produce the two separately. We discuss the economics of vertical integration in section II C 10.

Lastly there are economies of density, which exist when customers are sufficiently close to each other geographically (such as in the case of urban customers) to make their marginal costs lower than the marginal cost of the average customer. Economies of density lead service providers to target dense populations before targeting more dispersed populations. Targeting dense populations allows the operator to achieve a lower average cost faster, which improves the commercial viability of a product. For this reason a regulatory requirement to offer services in rural areas as well as in urban areas early in the introduction of a service can discourage the introduction of a new service because the requirement increases the average cost of providing the service.

Situations arise where a service provider might be able to achieve production economies through joint ventures or other business relationships. As we explain in the section on vertical integration in this paper, business transactions, including joint ventures, can raise complex contracting issues and the costs of addressing these issues at least partially offset the production economies.

10. Vertical Integration

a. The Economics of Vertical Integration

Production of products or services moves through several stages, from the acquisition of raw materials, to refinement, to creation of basic components, etc. until a consumer acquires and consumes the final product. It is conceivable that all of these functions could be performed by a single firm or by a large number of small, highly specialized firms. But both of these extremes are rare in a modern economy. Even in situations where a single firm mines coal, transports the coal to an electric generating plant, generates electricity, and delivers the electricity to end-use consumers, the firm does not produce the wires, poles, vehicles, etc. that the firm needs to perform its functions. And even in situations where a firm is highly specialized, say in providing video entertainment such as television, the firm often owns distribution facilities, film libraries, and the like, and also does its own marketing, legal work, etc. In summary, a modern economy is characterized by firms that are involved in more than one stage of product or service provision. This is called vertical integration.

Firms' positions in the stages of production, also called the value chain, are referred to as being upstream or downstream. An upstream firm is one that performs functions in the early stages of production, such as when a firm extracts raw materials from mines. A downstream firm is one that performs functions in the latter stages of production, such as providing a telecommunications service to a business.

There are many reasons why a firm might be vertically integrated. One reason is taxation. If a market transaction is taxed, but an internal or integrated transaction is not, then it is more economical for a single firm to provide two stages of production than for separate firms to do so, all other things being equal. By "market transaction" we mean an exchange of products or

services between two legally separate entities, such as between a telecommunications equipment manufacturer, such as Nortel and a telecommunications service provider, such as Vodafone. An internal or integrated transaction is a transfer between two stages of production within a firm. This might not look like a transaction – the upstream stage may simply pass the unfinished product to the next stage without any formal accounting – but it generally is referred to as an internal transaction. (Blair and Kaserman, 1985, pp. 285-286)

Another government-induced reason for vertical integration is the imposition of price controls. (Blair and Kaserman, 1985, pp. 286-288) For example, suppose that in an unregulated situation there are both cell tower providers and mobile network providers and that the tower providers construct 100 towers and the network providers use the 100 towers to serve 1,000,000 consumers. Further suppose that the tower providers lease space on their towers for X Baht per month. In this unregulated situation both sets of operators make choices that provide them with the most profits they can receive given the number of rivals, their production costs, and consumer demand. Now change the situation by assuming that a regulator decides that the price of X Baht per month is too high and imposes a price cap of x Baht, where $x < X$. Because the price the tower providers can charge in the regulated situation is lower than in the unregulated situation, they provide fewer towers, say only 70 towers, and they make less profit than in the unregulated case. Having fewer towers means that the mobile providers must serve fewer customers and like the tower providers, the mobile providers receive lower profits than in the non-regulated case. However, the tower and mobile providers can resolve this situation by vertically integrating. With vertical integration, the operators avoid the price control and so can simply price retail mobile services according to market demand. Presumably this vertical

integration is less efficient than vertical separation – otherwise the firms would have vertically integrated in the non-regulated case – but the firms are better off than with the price controls.

A third government-created incentive for vertical integration is retail price controls that incorporate costs of upstream products. This appeared to be part of the motivation for AT&T to vertically integrate both manufacturing of telephone equipment and the provision of telephone service.[22] AT&T's telephone services in the United States were regulated under rate of return regulation, which meant that the regulated services could receive only a normal rate of profit[23] on its regulated services. There is some belief that AT&T attempted to bypass this profit restriction by having its manufacturing affiliate, Western Electric, sell its telephone equipment at high prices to its regulated affiliates, AT&T Long Lines and the Bell Operating Companies, thus allowing AT&T to receive some profits in its manufacturing arm that it would have received in its service arms had the company not been regulated with rate of return regulation. (Horwitz, 1989, p. 137)

There are also non-government induced reasons to vertically integrate. In competitive markets, technology interdependencies and transaction costs provide incentives to vertically integrate. Technology interdependencies exist when the nature of technology makes stages of production work as a continuous process. For example, one could imagine that the various stages of an auto assembly line could be separate companies, but as a practical matter the assembly production processes imply a continuous flow of assembling the various parts and completion of an automobile. (Blair and Kaserman, 1985, 291-292)

[22] AT&T's initial motivations might have been different than those described here because the company vertically integrated prior to the development of rate of return regulation.
[23] The normal rate of profit was defined as the cost of equity and incorporated into the weighted average cost of capital. (Estache et. al, 2003)

A transaction cost is a cost imposed by a market and that would not exist with vertical integration. There are basically three forms of transaction costs. The first is called search costs, which are the costs that are incurred for buyers and sellers to find each other and agree upon prices. In modern businesses these costs are found in marketing, procurement, and legal departments. A second type of transaction cost might be called contracting costs, which are the costs of negotiating complex contracts that specify product features, delivery, and other legal arrangements. The third type of transaction cost is the cost of reduced flexibility that occurs because of the rigidity of contracts. Often firms need to adjust their products, processes, and planning because of exogenous events, such as the development of new technologies. In the case of vertical separation, the supplier and buyer would need to renegotiate their contracts to respond to the new technology. This can be costly and/or uneconomic. If costly, contracting transaction costs are incurred. If uneconomic, then the inflexibility transaction costs are incurred. (Coase, 1937; Blair and Kaserman, 1985, pp. 292-293)

Vertical integration allows firms to avoid these transaction costs. One way vertical integration decreases transaction costs is that it turns market adversaries – the buyer and the seller – into associates who have common interests. The integrated enterprise avoids search costs, has no contracting costs, and no inflexibility costs, at least as they relate to contract renegotiation, unless there is a functional or structural separation. Secondly, the integrated firm has a wider range of options for process control than do the separate firms. The vertically separate firms can use contracts only to coordinate activities and can use only data that the firms agree to share. We would expect firms to be reluctant to share information, such as cost information, that would affect individual profits during contract negotiations. The vertically integrated firm can use contracting arrangements if such arrangements are the most efficient

method of coordinating interactions, but it also can use personnel changes, training, internal audits, and other internal processes while having complete information on all stages of production.[24] (Williamson, 1971, 1974; Blair and Kaserman, 1985, pp. 293-294)

Another motivation for vertical integration might be to avoid what is often called double marginalization. Double marginalization occurs when the price of an input sold to the downstream firm is higher than the marginal cost of the input and the upstream and downstream firms individually make their production decisions. When the downstream firm decides how much of the final product to produce, it rightly treats the mark-up in the input price as a cost. This leads the downstream firm to choose a lower level of production of the final product than would a vertically integrated firm, which would only consider the marginal cost of the input as a cost of producing the final product. However, vertical integration is not the only way to avoid the problem of double marginalization. The upstream and downstream firms may negotiate a two-part tariff that allows the input price to reflect marginal cost while giving the upstream firm its profits through a monthly or annual fixed fee. The firms may also agree upon a profit or revenue sharing arrangement and jointly make the production decision.

Concerns arise that vertical integration may result in barriers to entry. In some instances the barriers to entry arise naturally from the cost structure of the industry. For example it might be the case that there are significant economies of scale in the upstream product market, making it hard for a firm to enter this market.[25] If firms in the industry are vertically integrated, then a

[24] This discussion of the potential benefits of vertical integration should not be understood to imply that vertical integration is always beneficial. It might be that bureaucratic costs exceed transaction costs. By bureaucratic costs we mean the costs of setting up accounting and control systems that would be needed to ensure that the integrated firm makes economical decisions at all stages of production. Markets can reveal economic costs that accounting systems can only approximately. It might also happen that labor contracts inhibit a vertically integrated firm from economically adjusting its upstream production processes, whereas a standalone downstream firm could avoid the labor problems by changing upstream suppliers.

[25] It is not necessary that the upstream firm be a monopoly. It might be that the scale economies are sufficiently significant to require a firm to achieve a large size before it can compete with rivals. Achieving such as size might

firm that desires to enter the downstream market must also be vertically integrated or persuade a vertically integrated rival to sell the upstream product. Entering both stages of production would be risky for a new entrant, which might make raising capital difficult. Furthermore a vertically integrated rival would not be expected to sell its upstream product unless the sale increased profits relative to the status quo. (Blair and Kaserman, 1985, pp. 314-315)

b. Competitive Consequences of Vertical Integration

What effects does vertical integration have on market competition? One approach to considering this question is called the market foreclosure doctrine. By this doctrine, vertical integration necessarily removes an input supplier from the market, which reduces the competitive options for downstream firms that need to purchase the input. Also by this doctrine if there are advantages to vertical integration, then firms that for some reason do not vertically integrate are at a competitive disadvantage. (Blair and Kaserman, 1985, p. 322) Economists are skeptical of the foreclosure doctrine because it presumes that the vertically integrated firm is unaffected by the input market. This is of course incorrect for a vertically integrated firm that seeks to maximize its profits because the firm will always consider whether it is more profitable to self supply the input or purchase it on the open market, and whether it is more profitable to sell on the open market the input it produces or use the input internally. As a result the vertically integrated firm acts just like the vertically separate firms and influences the input market. (Allen, 1971)

Another view of the competitive consequences of vertical integration is the economic view set forth by Blair and Kaserman (1985, pp. 336-338). In this view most motivations for

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be costly in terms of the economic losses that are incurred during the time that it takes to achieve the size. These losses are a barrier to entry.

vertical integration, if acted upon, actually benefit the economy by lowering costs. Furthermore this view explains that vertical integration leads to inefficiency only if there is horizontal market power.[26] Based on these understandings of vertical relationships, the economic view would recommend investigating vertical integration only if there is horizontal market power and if the integration appears to hinder competition in either the upstream or downstream market.

D. Conduct Issues

Situations can arise in which an operator has an incentive and an opportunity to engage in conduct that harms rivals and customers. The WTO agreement on basic telecommunications addresses such issues, specifically mentioning conduct such as engaging in anti-competitive cross-subsidization, using information obtained from competitors to limit competitive pressures, and not making available to rivals on a timely basis the technical information about essential facilities and other information necessary for them to provide services. In this section we examine conduct that limits competition. We begin with an examination of unilateral actions that hinder competition. We then discuss collective activities that limit competition.

1. Cross subsidization

When a firm has market power in one market and competes in other markets where it does not have market power, there is generally a concern that the firm might cross-subsidize its potentially competitive markets with profits from noncompetitive markets, might engage in predatory pricing, or might favor its own services over rivals' services with respect to access to

[26] Horizontal market power could be either the ability to raise prices through monopoly power above competitive levels in the input market or the ability to lower prices in the input through the exercise of monopsony power.

essential facilities (Baumol, 1979; Trebing, 1984). We draw a distinction between cross subsidization and predatory pricing and address the former in this section.

In economics the standards of stand-alone cost[27] and service incremental cost provide respectively the maximum and minimum bounds for subsidy-free prices (i.e., prices that do not involve a cross-subsidy), subject to two important caveats. The first caveat is that these tests apply not only to individual services, but to groups of services as well (Faulhaber, 1975). The second caveat is that the firm is not subject to multilateral rivalry – which is a situation where a firm's most efficient rivals, including potential rivals, operate in markets where this firm does not (Jamison, 1999, pp. 89-91). In the case of multilateral rivalry, prices are subsidy-free as long as:

1. The firm's revenues equal its economic costs;
2. All subsets of the firm's products generate revenues that are no greater than those generated by the lowest prices a competitor could charge while earning zero profits and charging subsidy-free prices for its other products; and
3. All subsets of the firm's products generate revenues that are no less than the incremental costs they create in the economy, which may be greater than the incremental costs measured at the firm level (Jamison, 1999, pp. 118-119).

This economic concept of cross subsidy is based on the idea that a cross subsidy does not exist within a firm's pricing unless some of the markets that the firm serves would be made better off if the firm quit serving the markets that are being subsidized. In this case, "better off" means that the customers in those segments could pay lower prices for the services if the firm

[27] Stand-alone costs include all of the volume-sensitive costs and service-specific fixed costs for the service or services in question, the shared costs that are needed only by the service or services in question, and the shared costs that are needed by the service or services in question plus those that may be shared with other services not included in the stand-alone cost estimate. (Jamison, 1999, pp. 20-23)

stopped serving the subsidized segments. To illustrate this simply, assume that a telecommunications firm offers both voice telephone services and broadband access. Providing voice service alone would cost 1 billion Baht, providing broadband alone would cost 2 billion Baht, and providing both together costs 2.3 billion Baht. It is less costly to jointly produce the services than to produce them separately because of economies of scope. Now suppose that the firm chooses prices that result in voice customers paying 0.9 billion Baht for their service and the broadband customers paying 1.4 billion Baht for their service. This pricing scheme gives nearly all of the benefits of joint production to the broadband customers; the broadband customers pay 0.6 billion Baht less than they would if they had a standalone network and the voice customers pay only 0.1 billion Baht less than they would if they had a standalone network. This may appear unfair, but it does not involve a cross subsidy because if the firm stopped providing the broadband service the voice customers would actually experience a price increase.

Detecting a cross subsidy is very hard. It requires significant amounts of data and numerous computations of costs of hypothetical service arrangements. As a result it is very rare for analysts to try to fully test for the existence of cross subsidies.

2. Predatory Pricing

In general predatory pricing is considered to exist when a firm prices with the intent of driving rivals from the market, or of keeping potential rivals from entering a market, without regard to the profit impacts of the pricing strategy. The strategy involves two pricing stages. In the first stage, called the predatory stage, the predatory firm forgoes profits to price the target

firm(s) out of the market. In the subsequent stage, the predatory firm raises its prices to capture the forgone profits plus additional profits.[28]

Areeda and Turner (1975) offered what is probably the most common definition of predatory pricing. They argue that a price is predatory if the price charged is so low that the firm would be better off not selling the product than selling it. This means that prices above marginal cost are not considered predatory and that prices below marginal cost are not considered predatory as long as the prices exceed average cost. Given the difficulty of estimating marginal costs, Areeda and Turner suggested using average variable cost as a proper measure of predatory pricing. (Blair and Kaserman, 1985, pp. 124-128)

Even though the Areeda-Turner rule is the most frequently mentioned, it is not without its critics. Some analysts believe that it is too generous to possible predators. These critics propose using average total cost as a standard. Others argue that predatory pricing is so rare and subject to so many caveats that there should be no legal rules against it (Viscusi et. al, 2001, pp. 277-279).

Economists typically are skeptical of the concept of predatory pricing because it is difficult to construct a situation where it is profitable for a firm to engage in predatory pricing and because a clear case of predatory pricing is yet to be found. Predatory pricing is thought to be irrational because for the predatory conduct to be rational, the predatory firm would have to be able to make up for the short term losses by raising its prices above a competitive level later. This need to receive extraordinary profits in the second stage leads some economists to question predatory pricing as a realistic strategy because the predatory firm must find a way to ensure that the profits do not attract entry. However, if the predatory firm could exclude rivals without lowering profits, it probably would have done so in the first stage, which would have meant that

[28] Firms can conspire together to engage in predatory pricing.

predatory pricing was never needed (Larson, 1989). Some people argue that the predatory activity establishes a reputation so that entry does not occur in the post-predatory, high price stage, but this scenario is hard to find in practice. (DiLorenzo, 1992)

3. Information Obtained from Rivals

Sometimes when competitors obtain facilities from rivals, such as an incumbent, the incumbent can learn about the competitors' businesses and use that information to its advantage. For example if a customer wanted to switch its telephone line from the incumbent to the competitor, the incumbent might learn about this when the facility change is requested and might then launch a marketing campaign to convince that customer to not change its service. This puts the competitors at a disadvantage because they must expend their marketing efforts over the entire marketing area while the incumbent only needs to target its marketing to the customers who actually seek to change service providers. This cost disadvantage for competitors discourages them from entering and those that do enter have to charge higher prices than they would otherwise.

4. Network Technology Information

There are situations where a downstream firm relies upon a vertically integrated firm, usually an incumbent, for network facilities. When this occurs there exists the possibility that the vertically integrated incumbent will introduce a technology change in its network that necessitates a technology change on the part of the downstream firm if the leasing firm is to continue to use the incumbent's facilities. It can happen in these situations that the incumbent does not inform the downstream rival of the technology in time for the downstream firm to make

the needed changes, causing service disruptions for the downstream firm's customers and causing extra costs for the downstream firm. Why might a vertically integrated firm do this? There might be times when it is simply an accident or an oversight, or the communication is made but the downstream firm's employee that receives the notice fails to properly process it. It might also be the case that an exogenous event causes the technology change to happen quickly and it is impossible to provide the downstream firm with sufficient notice. In both scenarios the lack of notice lowers economic efficiency, but the causes are beyond the control of the incumbent.

It might also happen that the incumbent deliberately withholds or delays the information. In general we would expect this to happen only if it improves the upstream firm's profits, which could happen if the failure to provide timely notice saves the incumbent costs, or, if the downstream firm primarily takes retail customers from the incumbent and the incumbent's profit margin on leasing facilities is low relative to its profit margin on its retail services. Offsetting these factors that lead to lower profits are the possibility that the downstream firm expands the demand for the retail service, perhaps by being more efficient in providing retail functions than the incumbent and so lowering the retail price, serving niche markets that the incumbent does not serve, providing a higher quality service than the incumbent, or increasing awareness of the retail service. So as we can see it is not always in the vertically integrated firm's interest to hinder its downstream rival.

5. Case Study of an Investigation into Anticompetitive Conduct

OFTA, the telecom regulator in Hong Kong, considered a complaint of anticompetitive conduct on the part of Hong Kong Telecom CSL Ltd. ("HKTCSL").[29] The complaint alleged that HKTCSL employees attempted to persuade three customers, who had requested to have their phone numbers to be ported to another carrier, from doing so by offering service and handset pricing packages. The employees were using information from a mobile number portability form, which should be used only by employees who actually perform the porting function and not by marketing personnel. In its investigation, OFTA contacted the three customers by phone and requested HKTCSL to provide an explanation concerning the complaint. The three customers confirmed that HKTCSL representatives had called them, but the customers indicted that the employees were unsuccessful in persuading them to cancel their porting applications.

HKTCSL admitted "that some of its employees who handled porting-out applications had wrongly referred the names of the porting-out customers to those responsible for customer retention programme. Hence, the names of these customers had been included in a contact list used for a recent promotional programme and subsequently called by the staff of customer retention programme."[30] HKTCSL gave OFTA assurances that it had taken steps to stop the practice. Based on HKTCSL's positive response and the fact that no customers had been dissuaded from switching suppliers, OFTA found that HKTCSL had not breached its license.

6. Price Fixing by Cartels

Price fixing occurs when the suppliers in a market agree to charge prices above the competitive level or to restrict output. This is called a cartel.

[29] Case Reference: L/M T59/99 in OFTA T49/13, March 1999. http://www.ofta.gov.hk/en/c_bd/completed-cases/hktcsl-9903.html, downloaded July 8, 2008.
[30] OFTA http://www.ofta.gov.hk/en/c_bd/completed-cases/hktcsl-9903.html, downloaded July 8, 2008.

A cartel can include all of the suppliers in a market or only some of the suppliers. Clearly if the cartel includes all of the suppliers it is better able to restrict output or raise price than if the cartel includes only a few suppliers, but a cartel might be profitable even if only some suppliers participate. OPEC is an example of a cartel where a few major oil exporting economies agree upon production levels and let markets establish the prices. The prices are above competitive levels because the OPEC countries have restricted output even though not all oil exporting countries are members of OPEC.

There are several factors that affect a cartel's ability to function. One such factor is market entry. Once a cartel begins to limit output or raise prices, other firms have an incentive to enter the market. So to be successful the cartel must find a way to limit entry. Successful methods for restricting entry include convincing the government to (1) require entrants to obtain government licenses, and (2) either limit the number of licenses or impose costs on new licensees that limit the economic attractiveness of entry. Another method is to obtain patents on key technologies and limit the number of firms that can license the patented technology. A third method of limiting entry is to control essential facilities and limit access to the essential facilities. (Blair and Kaserman, 1985, pp. 138-140)

Another issue that affects the success of cartels is the degree to which firms have different costs. Some firms might be more efficient than other firms in a market, owing to superior management ability, favorable access to key production facilities, favorable tax treatment or subsidies from the government, and the like. If the most efficient firms are able to reach an agreement to be a cartel, then their success is affected by the degree to which they are more efficient than other market entrants. In general, the less efficient the new entrants that do

not join the cartel, the lower the impacts these entrants can have on the success of the cartel. (Blair and Kaserman, 1985, pp. 140-141)

Cheating within a cartel also impacts those cartels. Suppose that three mobile operators with identical costs agree to form a cartel and there is no market entry because of government restrictions or some other obstacle. Further assume that the cartel decides to charge a price of *B* Baht that is greater than the price that would prevail if the operators did not collude. However, once the agreement is reached, each operator has a strong incentive to cheat because as long as the other two operators maintain the high price, the cheating operator can offer a lower price and take a significant market share. Therefore it is important to the cartel that it enforces the agreement. Enforcement requires that the operators have the ability to observe each other's prices and to punish any operator that fails to keep the agreement. Observing prices is easy if prices are published, such as in regulated tariffs or in a transparent market, such as in the case of prepaid cards or in transparent bidding for government contracts. Prices are harder to observe if they are in private contracts.[31] (Blair and Kaserman, 1985, pp. 132-145) Therefore collusive agreements in telecommunications are less likely when there are private contracts than when prices are public.

Enforcement of collusive agreements is hard because options for punishment of cheaters are limited. Absent a formal contract that can be enforced in courts, which would be unlikely, cheaters have to be punished in a way that makes the cheating unprofitable. In situations where at least one of the colluding firms controls resources such as an essential facility that the cheating rival needs, control of such resources could be used as an instrument to punish cheaters. However, this does not keep the firm that controls the essential facility from cheating itself.

[31] Sometimes firms agree upon production quotas, such as in the case of OPEC. But in industries such as telecommunications, it is very hard to observe operators' sales amounts, so price agreements are more likely.

Cheating is unprofitable or at least provides few extra profits when it is easy for non-cheating firms to instantly or at least very quickly match the cheating firm's prices. This is why analysts are concerned if they see promises by a firm to match rivals' prices or to always price a certain percent below its rivals. The promises may indicate that there is collusion, perhaps even informally, because the promise if kept ensures that rivals would not profit from lowering their prices. (Blair and Kaserman, 1985, pp. 141-145)

7. Dividing the Market

An alternative to colluding on price is to divide the market. (Shenefield and Stelzer, 2001, pp. 50-51; Blair and Kaserman, 1985, pp. 164-169) When firms divide the market they each agree to limit the scope of their operations in a way that is easy to observe, such as geographically. For example, firms might agree to build networks only in separate districts of a city. This gives each firm a separate geographic market and it is easy for the colluding firms to observe if another firm cheats. Firms might also divide markets along customer or service lines, or they might agree to limit the contracts for which they will compete.

E. Summary

We have identified several demand side, supply side, and conduct issues that limit competition. On the demand side we found that switching costs limit competition because they make it more costly for a service provider to take a customer from a rival than for the rival to retain the customer and they create barriers to entry. Network effects can change the nature of competition by creating winner takes all markets. Customers may also lack proper information to make purchasing decisions, which limits their abilities to choose amongst competitors.

On the supply side we found that sunk costs and licensing restrictions limit competition by making entry more costly. We also found that an incumbent can have first mover advantages, which can give the incumbent a cost advantage over rivals, superior access to scarce resources, name recognition, and an advantage in establishing long term contracts. A first mover might also have technology leadership, opportunities to create switching costs, and lower search costs[32] than subsequent entrants, but a first mover might also suffer disadvantages, such as having legacy networks, incurring the costs of making mistakes that subsequent entrants learn from, and a possible legacy reputation.

The presence of essential facilities can also limit competition. A firm with essential facilities should be required to provide rivals with access to the facilities if the firm is vertically integrated and has monopoly control of the essential facility, downstream rivals cannot reasonably duplicate the essential facility, the vertically integrated operator denies rivals access to the essential facility, and it is feasible for the vertically integrated operator to provide access. We found that geographic availability of a service matters when assessing competition if firms have limits on their ability to price differently in different geographic areas.

Exclusive rights to technologies can limit competition, but this is not always the case. Exclusive rights are less problematic if the firm with the rights is also the inventor of the technology than if the firm simply has an exclusive contractual right to import the technology. However, even in the case of imported technologies, there are situations where exclusive rights are actually beneficial to consumers. Similarly, exclusive rights to distribute a service can limit competition, but can also be beneficial to consumers. So in both exclusive rights situations, the regulator would have to study the impacts of the exclusivity before knowing whether to respond with a regulatory remedy.

[32] Search costs are costs that consumers incur to learn about possible service providers.

Limited access to capital can be a barrier to entry. If the limited access results from imperfections in the capital market, there may be little that the regulator can do but recognize that existing firms will have market power. However, if the limited capital is a result of anticompetitive conduct, the regulator may need to remedy the situation.

Economies of scale or economies of scope can be a barrier to entry, but should not be a barrier to competition between existing firms.

Vertical integration is a problem only if the vertically integrated firm has market power in the upstream market. But even when the integrated firm has this market power, it does not mean that the integration harms competition. The regulator would need to examine the actual impacts of the vertical integration.

Several forms of conduct might limit competition. Cross subsidization might limit competition, but it is hard to detect. Predatory pricing might limit competition, but there is significant controversy over whether predatory pricing ever truly happens. Firms have been known to obtain information from rivals and use it to gain competitive advantage, but this is not anticompetitive unless there are asymmetries in the opportunities to gain information and the information is used to sabotage the rivals. Similarly, holding back network information can be anticompetitive if it is done to sabotage rivals.

Price fixing is another conduct issue that, if it happens, lessens the competition in a market. However price fixing can be hard to accomplish. A similar collusive strategy would be to divide the market.

III. Remedies for Lack of Competition

Sector regulators, competition regulators, courts, policy makers, and others have developed a number of remedies for the lack of competition. These remedies range from those that seek to decrease market power to those that seek to dampen the effects of market power by directly controlling the firms with market power. We examine these approaches in this section.

An overarching principle that should be kept in mind when adopting a remedy is that the purpose of the intervention is to impact the market outcomes in a way that moves prices, output, service quality, service innovation, and the like closer to what we would experience were markets fully competitive. As Alfred Kahn (1998) explains, it is sometimes tempting to try to change outcomes to something that is more comfortable politically than the results of full competition. For example sometimes sector regulators and policy makers have kept retail electricity prices below commercially viable levels in an attempt to protect consumers from market fluctuations.[33] Similarly telecommunications regulators have sometimes attempted to protect inefficient service providers by providing subsidies or constraining rivals. Such attempts to bias competitive outcomes to favor a particular firm or group introduce contradictions within the regulatory system that ultimately lower efficiency and harm customers.

A. Interconnection

Interconnection is the linking of telecommunications networks together to allow the users of one network supplier to communicate with users of another network supplier and to access services provided by another provider. There are two types of interconnection. One way interconnection occurs when one service provider purchases interconnection from another, but

[33] See for example the case of the Maryland Public Service Commission where retail prices for consumers were frozen when competition was introduced in electricity. (Jamison et al. 2006)

the second provider does not purchase interconnection from the first. Examples of one way interconnection include leasing unbundled network elements and long distance access.

The second type of interconnection is two way interconnection, where two network operators purchase interconnection from each other. There are instances in two way interconnection where the operators do not compete against each other because they serve separate geographic areas, but we will limit our consideration to situations where the operators do compete.

Two-way interconnection of competing networks is generally required by regulators to limit the extent to which network effects might favor one operator over another and to provide consumers with the convenience of being able to communicate with more users than just the users of a single network provider. When competition is new, dominant firms can exclude fledgling rivals by denying or delaying interconnection, charging high fees to their rivals, or providing low quality connections (Laffont and Tirole, 2000, 184). Another reason that regulation of interconnection is important is that strategic interests, intense rivalry, and the complexity are so great in network interconnection that network operators rarely successfully negotiate interconnection agreements without regulatory intervention. (Jamison, 2007b)

Interconnection policies cover a number of issues, including pricing, costing methods and models, publication of prices, practices for providing network information, and standard offers. We cover each of these next.

1. Interconnection Pricing

The most common practice among regulators is to price interconnection based on long run incremental cost (LRIC) or total service long run incremental cost (TSLRIC). LRIC is an

approximation of marginal cost[34] and is the estimated cost of the additional investment, capital costs associated with the investment, and other costs associated with additional consumption or use of a service in the long run (Kahn and Shew, 1987). TSLRIC is an approximation of service incremental cost[35] (Larson and Parsons, 1995). In some instances TSLRIC has been called Long-Run Average Incremental Cost, Long-Run Service Incremental Cost, and Long-Run Incremental Cost–Total Service. Jamison (2002b) explained the difference between TSLRIC and LRIC this way:

> In theory, the differences between TSLRIC and long-run incremental cost, the cost measure that AT&T advocated in the 1960s, are that: (1) TSLRIC includes the investment and expense associated with producing the entire quantity of a service, whereas long-run incremental cost covers only a change in quantity; and (2) TSLRIC includes fixed costs caused by a service. These fixed costs – also called volume-insensitive costs – are caused by providing the service and remain constant regardless of the quantity of output produced. In practice, the difference between TSLRIC and long-run incremental cost is that TSLRIC includes fixed costs. As a result, TSLRIC can miss inframarginal costs and generally understates the costs a service actually causes.

Regulators tend to use incremental cost (formally defined as the cost of one more unit of production, or marginal cost) as the basis for interconnection prices for three reasons. One reason is that dominant firms can sometimes exclude fledgling rivals if interconnection fees are higher than incremental cost (Laffont and Tirole, 2000, 184). In the early days of long distance competition in the United States AT&T tried to deny interconnection to MCI and when AT&T failed in that tactic, the company tried to charge interconnection fees to MCI that were higher than AT&T's own retail prices against which MCI had to compete (Brock, 1981, 227-228).

Another reason regulators price interconnection at incremental cost is that even if competitors are equal, each network provider still has an incentive to raise interconnection prices

[34] Marginal cost is the change in volume-sensitive costs resulting from a small change in output (Kahn, 1988, I p. 65-66).

[35] Service incremental cost denotes the extra cost imposed on the firm for providing an entire product line and includes both the fixed costs and the volume sensitive costs of providing the product. (Jamison, 1988; Baumol, 1979; Faulhaber, 1975).

to its rival networks in an attempt to gain market share by its raising rivals' costs. This can even lead to retail prices at the monopoly level. Network operators do not need to overtly or even consciously collude for this to happen: All each needs to do is act in its own best interest and seek to gain customers by disadvantaging its rivals (Laffont and Tirole, 2000, 184).

Finally, pricing interconnection at incremental cost facilitates efficient retail prices. Retail prices are considered efficient if they reflect marginal costs. Because interconnection prices paid are part of the cost of providing service, retail prices will reflect the incremental cost of interconnection only if the interconnection prices reflect their incremental costs.

Despite the popularity of incremental cost methods for interconnection pricing, they are not the only methods that can result in efficient prices. One such option is global price caps. With global price caps the regulator places all of the prices the firm charges, including prices for competitive services, in a single price cap basket, which leads the firm to charge prices that are based on Ramsey pricing principles.[36] (Laffont and Tirole, 1996) There are several drawbacks to global price caps. One problem is jurisdiction; for the global price cap to work the regulator must include all of the firm's prices and the regulator may not have jurisdiction over all of the services the operator provides. Furthermore the global price cap means that the regulator is overseeing prices in competitive markets, which can slow the competitive process and, if prices are publically available, could facilitate collusion by making it easier for colluding firms to detect cheating. Finally Ramsey pricing incorporates the idea that customers with the most price inelastic demand are the customers whose prices should be the highest relative to their marginal

[36] Ramsey pricing principles state that when marginal cost pricing is not feasible, perhaps because it would not provide revenue sufficient to cover all of the costs of the firm, then the second best solution is to charge prices that reflect the price elasticity of demand for the various services. The result is that the differences between prices and marginal costs are greatest for services with the most price inelastic demand.

costs. However, it is generally a purpose of regulation to protect these customers from high prices.

Another option for setting interconnection prices is called the generalized efficient component pricing rule (GECPR). This method states that the interconnection price that a firm pays should be equal to the firm's own retail price minus its rival's marginal cost of providing interconnection, but the interconnection price should never drop below the incremental cost of interconnection. This method encourages a firm to keep its retail price near competitive levels because every cent that it lowers its retail price results in a cent decrease in the interconnection price it pays. It is profitable for the firm to lower its retail price as long as the firm profits from the traffic stimulation, i.e. the extra calling that customers make because of the lower prices. (Mialon, 2005)

Yet another option for interconnection pricing is called Sender Keeps All or Bill and Keep. In this arrangement the operators do not pay each other for terminating calls at central offices. This approach can actually be more efficient than the incremental cost method because it recognizes that a customer who receives a call benefits from the call, but is not the party who decides whether the call should be made. The party who decides the call should be made, the calling party, chooses to make the call only if the value he receives from doing so is greater than the price of making the call. This focus on private value of the calling party can result in calls not being made that are actually beneficial. (DeGraba)

2. Costing methods and models

Generally regulators employ some method of estimating costs to develop cost-based interconnection prices. There are three basic options: (1) incremental cost models; (2) fully distributed cost; and (3) benchmarking. We discuss each of these in this section.

Incremental cost models are generally engineering process models that simulate how an operator might build and operate its network. Such models generally begin with an estimate of the investment required to provide the interconnection service. This estimate is annuitized over the expected life of the facilities to account for the impacts of the investment on the operator's cash flows and cost of capital. Then the model adds to the annuitized costs the out of pocket expenses of providing interconnection, such as maintenance costs, taxes, and the like.

There are a number of complexities in using incremental cost models. One complexity is that the cost models can sometimes appear as black boxes, meaning that they are hard to understand. To be useful, regulators have to trust that the cost analyst has done the right thing, so a preference should exist for having a transparent cost model, whether the model is provided by a consultant, an operator, or the regulator (Jamison, 2002b). Also the time horizon must be carefully defined, as must be the size of incremental investment over which to measure the change in costs (Kahn, 1988, I pp. 70-77). Time is important because it defines which costs can vary. In general regulators assume that all costs can be varied, which means they use long run costs. Also the size of the increment is typically the entire service so that both fixed costs and volume sensitive costs are included in the cost estimate. Finally, engineering cost studies involve making assumptions about how a firm should operate. The number of assumptions can be quite large and the discretion allows the possibility that desired modeling outcomes will influence assumptions (Weisman, 2000; Jamison, 2002b).

The critical assumptions for incremental cost models include the utilization factor or fill factor, the life of the facilities, technology, and expense amounts. The utilization factor is the percent of the facility's capacity that is assumed to be used. For example if a facility can handle 100 calls at its peak and only 70 calls are actually processed at the peak time, then the facility's utilization factor is 70 percent. The importance of the utilization assumption is evident from its calculation: a change in fill factor from 60 percent to 70 percent lowers the estimated per unit investment cost of providing the service by about 14 percent. The life of the facility also affects the number of units of service over which investment costs are spread. For example if a facility is assumed to provide the same number of units of service each year, a change in service life from 8 years to 10 years lowers the per unit cost for facilities by 20 percent.

Technology is a critical assumption because it determines the investment cost. Often cost models assume the latest technology or the most efficient technology currently available. This ignores the impact of legacy networks, especially on incumbents. A legacy network may cause the real costs the operator incurs to be higher or lower than what a cost model would estimate assuming latest or most efficient technologies. Legacy network costs would be higher than the cost model results if the operator would incur extra costs to change out its network technology and these change out costs were omitted from the cost model. The legacy network costs would be lower than the model estimates if the model is unable to capture the existing efficiencies of the operator, perhaps because of a lack of information on the operator's actual network. They might also be lower if the older technologies are less costly to operate, but not sold today by manufacturers because the older technologies have fewer economies of scope than newer technologies, which diminishes their revenue potential. It might also be the case that the service

provider has so much experience using its legacy network that its maintenance costs are lower than they would be if the operator were to adopt a new technology.

Because of the difficulties and uncertainties of developing and using incremental cost models, some regulators are beginning to use an accounting approach to estimating interconnection costs. The accounting approach's key source of information is the utility's financial records and plant records. Financial records are the operator's accounting information on investments, expenses, and cash flows. (Horngren, Sundem, and Stratton, 2005, p. G1). There are three basic financial statements. The first is the cash flow statement, which records all of the cash inflows and outflows that result from the normal operations and projects that the operator undertakes (Crum and Goldberg, 1998, p. 57). The income or profit and loss statement records the revenue and operating expenses related to projects and normal operations, along with interest, taxes, and depreciation expenses (Crum and Goldberg, 1998, p. 52). Operating expenses are costs incurred for inputs that are used up within a year's time. Assets (facilities, other property and investments, current assets, and deferred debts) and liabilities (stock, long-term debt, non-current liabilities, current and accrued liabilities, and deferred credits) are recorded on the balance sheet (Crum and Goldberg, 1998, p. 47).

The accounting approach is primarily concerned with the assignment of costs to services in ways that seem fair and reasonable to the analyst or other observers (Bolter, 1978). To be reasonable cost assignments should be objective, not open to manipulation, and reflective of the business decisions that caused the costs to be incurred. Jamison (2006) explains that this typically involves two basic steps, but the second step may be omitted for some cost studies. The first step is to identify and assign direct costs or directly attributable costs, which are the accounting costs for production inputs that are needed only to provide a specific service or set of

services (Horngren, Sundem, and Stratton, 2005, p. G3). An example of a direct cost is the hourly wages paid to a maintenance worker who focuses specifically on the service in question. Assignment refers to designating an accounting cost amount as a direct cost of a particular service. An accounting cost study that stops at this first step is called a direct cost study or an embedded direct cost analysis if historical costs are used (Jamison and Brevitz, 1987).

The second step in the accounting approach is to allocate the remaining accounting costs across services. This typically has two parts. In the first part, the cost analyst identifies accounting costs that appear to be reasonably attributable to particular services or to activities whose costs have already been directly assigned. For example, specialized computing equipment used primarily to manage calls might be reasonably attributable to calling services, but it may be hard to directly assign the accounting costs to any one of these services, including interconnection. Such costs are sometimes called indirectly attributable costs. These costs are assigned to services one of two ways. In some studies, these costs are allocated across the relevant services using an allocator or cost driver that appears to be reasonably related to cost causation (Horngren, Sundem, and Stratton, 2005, pp. 44-46). Otherwise the costs are allocated across the activities to which they appear to be connected and that are directly assigned (Potter, et al., 2006, p. 44). Typically the allocators are measures of relative use. (Jamison, 2006)

Regulators that use accounting methods for interconnection typically rely heavily on operators' facility records. The facility records are used to identify which network facilities are used in providing interconnection. These facilities are then matched to the accounting records to determine the amount the operator paid for the facilities. In cases where the regulator wants to use current costs rather than historical costs[37] for interconnection, the regulator then applies an

[37] The values in an account may represent historical costs or current costs. Historical costs when they represent the dollars originally spent by the utility. The current cost approach generally begins with the historical costs and

inflation factor to the historical cost number, unless the operator has already done this in its accounting processes.

A third approach for identifying costs for interconnection is to benchmark against other jurisdictions. This approach was used by OSIPTEL staff in Peru. The staff gathered interconnection prices from various countries and used econometrics to regress the prices on factors that should affect telecommunications costs. The staff then used the regression results to estimate interconnection costs in Peru.

3. Publication of Prices

Many jurisdictions require that telecommunications prices be made publically available. Indeed some countries tariff interconnection and the prices are applied to any telecommunications carrier wanting to interconnect.

Once interconnection prices are published, the publication should reduce the likelihood of protracted interconnection pricing disputes because any operator requesting interconnection already knows the prices other operators are paying. Publication also provides transparency for the regulator's work. Publication of prices does disclose information about business operations that some operators may wish to keep private, so the prospects of publication may make initial interconnection pricing agreements more difficult.

In its study of telecommunications, the New Zealand Ministry of Economic Development concluded that disclosure of agreements fosters competition by informing the market about the terms and conditions for access to the incumbent's network. Regulations in New Zealand (at the time of the Ministry's study) required the publication of the full text of any interconnection

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applies inflation factors to express the historical costs in current monetary units (Crum and Goldberg, 1998, pp. 49, 65-72).

agreement with the incumbent, excluding details relating to the location of physical links for service delivery between networks at the incumbent's principal offices.[38]

4. Providing Network Information

It is common for regulators to require the provision of technical network information that is necessary for efficient operation of network interconnection. Without this information disclosure, the connectivity between the networks degrades and a dominant firm may be able to leverage its network effects to hinder its smaller rivals. Indeed the U.S. Federal Communications Commission adopted rules requiring network information disclosure. The rules require disclosure of the types of network changes planned, locations where the changes will occur, and foreseeable impacts of the changes. Notice of changes must be provided to the regulator and made public at least 12 months before implementation, although exceptions are allowed.[39]

5. Standard Offers

Standard interconnection offers also are common in telecommunications. The purposes of standard offers include decreasing the interconnection issues that must be negotiated, clarifying regulatory policy, and decreasing uncertainty for potential entrants. Tariffing is one form of a standard offer adopted by several countries such as Portugal, have tariffed interconnection.

[38] New Zealand Ministry of Economic Development, "4. Interconnection Agreements." http://www.med.govt.nz/templates/MultipageDocumentPage____4655.aspx. (Downloaded 21 July 2008.)
[39] §§ 51.325 through 51.335 of Title 47 of the United States Code of Federal Regulations.

B. Access to Essential Facilities

Regulatory requirements that operators provide rivals with access to essential facilities[40] can reduce barriers to entry by reducing sunk costs that an entrant may need to incur, providing on an economical basis the essential resources that are needed to provide service, reducing the need to raise financial capital and improve cash flows, overcoming exclusive rights to specific technologies, and diminishing the scale and scope economies that an entrant may need to achieve to be commercially viable. Policies for access to essential facilities, such as mandating the unbundling of network elements, have been shown to increase entry. (Jamison, 2002a) We described in section II C 4 – Control of Essential Facilities, the criteria for determining whether an input should be considered an essential facility. In this section we address pricing and access issues.

1. Pricing Essential Facilities

There are two typical methods for pricing access to essential facilities. One method is to base the prices on costs, typically incremental costs. The logic for this approach is that tying access price to cost might encourage the development of a least cost network. There are two operators involved in a transaction to provide an essential facility: a vertically integrated operator that has the essential facility and uses it to provide the downstream service, and a downstream firm that provides only the downstream service. When deciding whether to lease the essential facility or to attempt to vertically integrate and self-supply the input, the downstream firm is likely to weigh the price it would pay for leasing the input against the cost of self supply and choose the option that imposes the least cost from the downstream firm's perspective. If the

[40] We use the term facility, but the policies could apply to any input or resource, such as a building entrance or telephone numbers.

vertically integrated firm's incremental cost of providing the input is less than the downstream firm's incremental cost of self supply, then the least cost solution from an overall network perspective is for the downstream firm to lease rather than build. But the downstream firm would not make that decision correctly from an overall network perspective unless the price it were to pay for the essential facility were based on the vertically integrated operator's incremental cost.

The logic of the incremental cost approach sounds reasonable, but it omits some important features of actual markets involving essential facilities. One feature is the true nature of the essential facility itself. Recall from our previous section on essential facilities that the nature of such as facility is that it cannot be economically produced by the downstream firm. The logic of the incremental cost approach assumes that it might be economical for the downstream firm to self-supply, an assumption that is in conflict with the definition of an essential facility.

The other feature the incremental cost approach misses is how the decision by the downstream firm to lease the essential facility affects competition in the market. Jamison (2004) shows that when profit margins on essential facilities are less than profit margins on retail services, fewer competitors actually enter the market relative to situations where the profit margins are more equal. Jamison's study concludes that the smaller profit margin for the essential facility leads the vertically integrated firm to compete aggressively in the downstream market to keep the higher profit margin that the retail market provides.

The missing elements of the incremental cost approach are captured by a second approach, called the efficient component pricing rule (ECPR). The ECPR, which is also called the Baumol-Willig rule, suggests that the downstream firm should pay the vertically integrated firm for its opportunity costs. In other words, the prices the vertically integrated firm should

charge to downstream rivals would ensure that the incumbent would make the same amount of profit regardless of whether it succeed in the downstream the market. (Willig, 1979)

The ECPR formula for setting prices for essential facilities (called wholesale prices in the formula) is:

Wholesale price = Retail price - [Retail TSLRIC – Wholesale TSLRIC]

Or alternatively,

Wholesale price = Retail markup (above Retail TSLRIC) + Wholesale TSLRIC

For example, assume the vertically integrated firm would receive 2 million Baht serving a group of customers and would incur costs of 1.3 million Baht to do so. Further assume that providing the essential facility to a downstream firm that would serve these customers would cost 1.1 million. The set of ECPR-based prices for the essential facility would be a set of prices that would generate 1.8 million in revenue, i.e., 2 million – [1.3 million – 1.1 million] = 1.8 million.

The basic theory behind the ECPR is that, if the vertically integrated firm receives the same profits from the essential facility as it does from sales of the retail service, then a rival can enter and succeed in the downstream market only if it is more efficient in providing retail functions than is the vertically integrated firm. This aspect of the theory may not hold because of the stringent assumptions behind the ECPR, but the evidence indicates that it is better suited for encouraging competition than is the incremental cost approach.[41]

[41] The problematic assumptions of the ECPR include that there are no sunk costs and no monopoly profits, there is no discrimination against the entrant in price or quality of interconnection, the margin between the vertically integrated firm's input price and retail price reflects the vertically integrated firm's economic costs of producing the retail product, the retail market is homogeneous (i.e. products are identical to each other), downstream firms are price takers (i.e. they have no market power), and regulators are able to perfectly regulate the incumbent. (Tye, 1994; Kahn and Taylor, 1994; Willig, 1979; Armstrong and Doyle; Mitchell et al., 1995)

2. Non-discriminatory Access

Non-discriminatory access to essential facilities is important for the development of competition. To illustrate this point, we summarize the experience in the United States.

By 1996 the United States had tried several ways to structure telecommunications markets to separate the potentially competitive components from the more monopolistic components. (Jamison and Sichter, 2008) Therefore the goal of the new telecommunications law, the Telecommunications Act of 1996[42] (1996 Act) was to remove barriers to competition in all markets and use other methods, such as network unbundling and access to Operational Support Systems (OSS), to address market power.

The 1996 Act provided for three methods of entry – facility based entry, the use of incumbent unbundled network elements (UNEs), and resale of incumbent retail services – into what was viewed as the last non-competitive market, the local market. Each of these methods of entry relied, to varying degrees, on incumbents' capabilities. Facility based entrants required interconnection with incumbents to exchange traffic. Entrants using resale or UNEs were reliant on incumbents for services or facilities. (Jamison and Sichter, 2008)

Critical to the success of entrants using UNEs or resold services was the ability to obtain nondiscriminatory access to incumbents' OSS. This gave entrants real-time access to telephone number assignment, timely access to UNEs, and expeditious repair of incumbent facilities, for example. The FCC determined that components of incumbent OSS were themselves UNEs, and required incumbents to provide entrants with nondiscriminatory access to these systems. The FCC identified five key OSS functionalities that incumbents were required to unbundle and provide on a nondiscriminatory basis to entrants:

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

1. Pre-ordering
2. Ordering
3. Provisioning
4. Maintenance and repair
5. Billing[43]

The FCC further required the incumbents to develop electronic interfaces to their internal systems, permitting entrants to effectively access these systems in the same manner as the incumbent itself. To ensure that incumbents did not discriminate despite these OSS unbundling and access requirements, the regulators (largely the state regulators) went to considerable effort to develop performance measurements and reporting requirements in order to detect any discrimination. Many states adopted systems of financial penalties for incumbents to ensure that they had proper incentives to provide non-discriminatory access. (Jamison and Sichter, 2008)

C. Service Resale

Some regulators require operators with market power to sell their services at wholesale prices to rivals, who can then resell the services to retail customers. This policy addresses issues of network effects, sunk costs, control of essential facilities, exclusive rights to specific technologies, limited access to capital, economies of scale and scope, and certain forms of cross subsidization and predatory pricing.

The general practice for wholesale pricing is to use the ECPR, although in this context it is more commonly called retail minus, where the minus represents the avoided costs of the retail portion of the cost of providing the service. In the ECPR formula, this would represent the difference between the TSLRIC of the retail service minus the TSLRIC of the wholesale portion.

[43] Jamison and Sichter (2008).

In applying this policy, regulators in the United States established a formula that incumbents were required to follow to establish percent discounts off of their retail prices. These discounts averaged around 15 percent. Appendix A contains a list of the FCC's rules for calculating avoided costs.

Non-discriminatory access to OSS is important for effective resale. The principles and policies we describe in the section on non-discriminatory access to OSS for essential facilities apply to resale as well.

D. Structural and Functional Separation

Some countries require vertical separation of incumbent telecommunications providers. For example, the telecommunications regulator in the United Kingdom, Ofcom, recently required BT to functionally separate wholesale network services from retail services. (Blowers, 2007) A primary motive for such policies is to limit the ability of an operator that controls essential facilities to use that control to limit competition. (Fowler et al., 1986; Laffont, 2005, pp. 10-11)

There are four basic approaches to separating competitive or potentially competitive services from apparently non-competitive operations. The most severe approach is ownership separation, such as divestiture and line of business prohibitions. The next most severe approach is structural separation, where an operator provides both the competitive service and the non-competitive functions, but through separate subsidiaries. The third type is functional or operational separation in which both competitive and non-competitive operations are provided by a single entity, but the company must separate its operations. The least severe form is accounting separation, which we discuss in section E below. (Jamison and Sichter, 2008)

The most common approach under consideration currently is the idea of structural or functional separation of local telecommunications network providers into wholesale network services (NetCo) and retail services (RetailCo). The NetCo operates the network and provides network services to retail providers, including its own RetailCo. There were two actual attempts to implement such arrangements in the United States: One with Rochester Telephone in New York and one with Bell Atlantic-Pennsylvania (part of Verizon). The New York case was a voluntary separation and the Pennsylvania case was an involuntary separation. These and other attempts at vertical separation in the United States, where incumbents' stocks are publically traded and controlled by boards of directors with fiduciary responsibilities to shareholders, ended with few if any positive effects. In general the difficulties found included:

1. The separation lowered efficiency and delayed innovation. The natural boundaries of businesses in telecommunications are always changing and are difficult to predict, including the locations of bottlenecks.[44] Adapting business separation rules to new situations takes time, which causes delays that create costs, slow innovation, and may slow the development of competition.
2. Implementing and enforcing the separation can be costly for regulators because of lobbying of stakeholders who choose to compete in the regulatory arena rather than in the marketplace.
3. Behavioral rules are more effective than separation measures. Structural or functional separation promised benefits of increased competition and more transparent regulation,

[44] A bottleneck facility is "a point on a network through which all service products must pass to reach the ultimate buyers." (Source: Body of Knowledge on Infrastructure Regulation, http://www.regulationbodyofknowledge.org/glossary/define/Bottleneck%20facility/. Parenthetical omitted.)

but the actual experience was otherwise. Rules requiring equivalent competitor access to OSS were more effective.[45]

These difficulties indicate the issues that regulators should address if they desire to adopt a separation approach. Namely the approach would need to:

1. Provide a means for innovations to occur without delay, perhaps adopting an ex post approach to addressing discrimination should it occur.
2. Ensure that the point(s) of separation are truly long term bottlenecks that technology is unlikely to overcome. Examples might be conduit or cable in locations where more than one network is either physically impractical or prohibitively expensive, antenna or transmitter locations that are unique in their geographic reach, and building access.
3. Avoid developing business boundaries that may represent the conventional wisdom but that are in conflict with the emerging nature of the business.
4. Limit rivals' opportunities to gain strategic advantage through changes in regulatory rules
5. Use behavioral rules whenever possible as they are more adaptable than separation to new business economics and technologies.

E. Accounting Separations

Accounting separations are an attempt to control cross subsidization by separating an operator's accounting costs and revenues for non-competitive operations from those that are for competitive operations. It constrains an operator's ability to cross subsidize only to the extent that the regulator uses accounting information for regulating retail prices. Said differently, if the regulator uses pure price caps and does not either formally or informally use accounting

[45] Jamison and Sichter, 2008.

information when establishing price levels during a price review, then accounting separations imposes no constraints on an operator's ability to cross subsidize.

The basic methods of accounting separations are the same as any accounting based costing method.[46] Its key source of information is the utility's financial records and plant records. The central features of its reporting requirements are the three basic financial statements, namely the cash flow statement, the income or profit and loss statement, and the balance sheet. The cost assignments involve two steps. The first step is to identify and assign direct costs or directly attributable costs. The second step is to allocate the remaining accounting costs across services.

Furthermore the regulator should require that each operator maintain an accounting manual, subject to approval by the regulator, that details not only how the operator will follow the regulator's accounting standards, but also the accounting separations rules. Whether each operator is following these rules should be verifiable by the regulator through attestation by each operator's responsible accounting officer and through audits performed by the regulator or under the direction of the regulator.

Despite these basic similarities, accounting separation is different from cost allocations for service costs in several ways. One difference is that regulators would typically pay closer attention to transactions between non-competitive and competitive operations than they would pay to transactions between business service operations and residential service operations, for example, if both were regulated. Transactions between non-competitive and competitive operations frequently are called affiliate transactions because the context is often that the regulated operations occur within a corporate affiliate that is separate from the corporate affiliate that provides the non-regulated services; nevertheless, the principles and policies could apply to

[46] We cover these in the section on costing for interconnection.

integrated operations as well. Following are some model rules based on the rules of the U.S. Federal Communications Commission.[47]

(a) Unless otherwise approved by the regulator, transactions involving asset transfers between retail regulated and non-retail regulated, or the provision of products or services, into or out of the regulated accounts shall be recorded by the operator in its regulated accounts as provided in paragraphs (b) through (f) below.

(b) Charges for assets purchased by or transferred to the regulated activities from non-regulated activities shall be recorded in the operating accounts of the regulated activity at the invoice price if that price is determined by a prevailing price list held out to the general public in the normal course of business. If the assets received by the regulated activity are not marketed by the non-regulated operations to the general public under a prevailing price list, the charges recorded by the regulated activity for such assets shall be the lower of their cost to the originating activity of the non-regulated operations less all applicable valuation reserves such as depreciation, or their fair market value.

(c) Assets sold or transferred from the regulated accounts to non-regulated operations shall be recorded as operating revenues, incidental revenues or asset retirements according to the nature of the transaction involved. If such sales are reflected in tariffs on file with the regulator in price lists held out to the general public, the associated revenues shall be recorded at the prices contained therein in the appropriate revenue accounts. If no tariff or prevailing

[47] 47 CFR § 31.01-11 Transactions with affiliates.

price list is applicable, the proceeds from such sales shall be determined at the higher of cost less all applicable valuation reserves, or estimated fair market value of the asset.

(d) Services provided to non-regulated operations pursuant to a tariff filed with the regulator, shall be recorded in the appropriate revenue accounts at the tariffed rates. Services provided by non-regulated operations to the regulated activity, when the same services are provided by the affiliate to unaffiliated persons or entities, shall be recorded at the market rate. When an operator provides substantially all of a service to, or receives substantially all of a service from, non-regulated operations, and such service is not also provided to unaffiliated persons or entities, the services shall be recorded at cost, which shall be determined in a manner that complies with the standards and procedures for the apportionment of costs between the regulated and non-regulated operations as prescribed by the regulator.

(e) Income taxes shall be allocated among the regulated activities of the operator, its non-regulated divisions, and members of affiliated groups. Under circumstances in which income taxes are determined on a consolidated basis by the operator and other members of affiliated groups, the income tax expense to be recorded by the operator shall be the same as would result if determined for the operator separately for all time periods, except that the tax effect of carry-back and carry-forward operating losses, investment tax credits, or other tax credits generated by operations of the operator shall be recorded by the operator during the period in which applied in settlement of

the taxes otherwise attributable to any member, or combination of members, of the affiliated groups.

(f) The principles set forth in these rules shall apply equally to corporations, proprietorships, partnerships and other forms of business organizations.

Of particular importance in these rules is the control of cost reallocations. Many accounting separations systems rely upon measures of usage to allocate costs. For example if a regulator deregulated broadband to businesses, but not to residences, the regulator might require the operator to allocate investments in broadband facilities between the two markets based on their relative output. That is to say if the total demand for broadband was 1 million lines and 300,000 of these lines were for business, the regulator would have required that 30 percent of the investment be assigned to the non-regulated accounts. But what happens if the operator loses market share in the business market? Absent direction from the regulator to the contrary, the operator might simply recalculate the cost assignment using the new sales figures, resulting in a reallocation of investment from the non-regulated operations to the regulated operations. That is to say, if the business sales decreased to 200,000 lines, then the operator would assign only 22 percent of the investment to non-regulated accounts. The regulated accounts would receive 78 percent of the investment after the recalculation, in contrast to the original 70 percent. Note that the regulated side receives an increase in investment cost even though it had no increase in demand and no new investments were made. The regulator can avoid this reallocation by applying paragraph (a) in the model rules, which says that the assets of the regulated and non-regulated operations are separate and a transfer between the two cannot occur without permission of the regulator.

Finally the accounting separations rules and reporting should not be unduly burdensome to the operator and in fact should be informative. Any operator that is seeking to properly manage its operations would want to know how its various lines of business are performing financially. This implies that the operator should have its own accounting separation procedures. If both the operator and regulator are following proper accounting and economic principles in their accounting separation policies, they should have few actual differences. Also the regulator's enforcement procedures should not be unduly burdensome. A properly managed operator would want to have its own auditing system to ensure that its employees are complying with the regulators' rules and the operator's own rules, which we have said should not be very different from those of the regulator if both are following proper standards. If the operator is conducting its own audits, the regulator's audits if properly done should be only an incremental burden and should provide information that the operator would find useful.

F. Equal Access

Equal access is a policy that says there should be no difference in the method used to use one service provider over the other.[48] Equal access typically is used for services where a customer accesses a downstream service by going through a network that may be unaffiliated with the service. An example of equal access is international long distance where a mobile phone subscriber might be allowed to choose an international long distance provider that may not be the same carrier as the mobile service provider. Equal access is of concern primarily if the network is vertically integrated such that it offers the downstream service. In this case the main concern is with the vertical integration and whether it provides an opportunity and incentive for the

[48] Barbados Fair Trading Commission. 2005. "Policy On Indirect/Equal Access In Barbados: Policy in accordance with sections 4(2)(b) and 4(2)(f) of the Telecommunications Act 2001-36."

vertically integrated provider to discriminate against rivals, for example, by obtaining information about rivals based on network traffic and signaling. But equal access may be of interest even if the network is not vertically integrated because equal access can also address issues of switching costs, limited rights to particular technologies, and limited rights to distribution arrangements. The limited rights to technologies and distribution arrangements are similar in nature to the exclusive rights we discussed above in section II C 6.

There are four basic elements of equal access. The first element is the ease with which a customer can choose to use alternate providers. Equal access generally attempts to treat all rivals the same by, for example, requiring that all international long distance providers be given the same dialing arrangements. The second element of equal access is equality in quality of the interconnection; interconnection should not create a difference in quality that the customer can detect. The third element of equal access is equality in cost; an operator should not be put at a cost disadvantage to its rivals simply because of differences in interconnection arrangements. The last element of equal access is equal access to customers by rival operators. No rival should be given superior access to customers or customer information by nature of its interconnection arrangement. Some jurisdictions have gone so far as to require a time period for customers to have a fresh look and change service providers when equal access comes available, but this is not uniformly done by all jurisdictions and for all services.

The availability of equal access does not mean that all service providers receive equal service. In some jurisdictions service providers are allowed to choose inferior types of interconnection and pay a lower price. This is an accepted practice as long as service providers are free to choose and the arrangements are not designed to uneconomically favor one type of service provider over another.

G. Number Portability

Number portability allows subscribers to change their services while retaining their old telephone number. Portability lowers switching costs, which increases the level of competition between service providers.

There are three basic types of number portability. Operator portability allows a customer to change service providers and keep her old phone number. Geographic portability allows a customer to change locations and keep her number. Service portability allows a customer to change modes of communication, say from fixed line to VoIP, and keep her number. Portability is more important when penetration rates are high than when they are low, because when penetration rates are low, the unmet demand promotes competition. But operator portability both for fixed and mobile services and service portability have been implemented in various countries even when penetration rates are low.[49] Forms of number portability can be combined. For example operator portability can be with without geographic limits, meaning a customer changing service providers can simultaneously move between cities and keep the same phone number.

There are three basic types of benefits of number portability. The customer who has ported her number has saved switching costs, such as cost of notifying people of the number change and missing calls from people who want to call her. Another benefit is the lower prices that operators will charge for services because switching costs are lower. The third benefit is the savings from fewer incomplete calls and fewer equipment changes, for example for consumers

[49] Telecom Regulatory Authority of India, 2005. "Consultation Paper on Mobile Number Portability." New Delhi, India. (Hereafter, TRAI Consultation.) TRAI defined number portability in this way "Number portability enables a subscriber to switch between services, locations, or operators while retaining the original telephone number, without compromising on quality, reliability, and operational convenience."

who have stored the customer's phone number in their devices. (NERA, 1998; TRAI Consultation) Based on experiences in the United States, it appears that larger customers receive most of the benefits of the price decreases because the cost of changing a phone number is greater for a larger customer than a smaller customer. (Park, 2008)

There are three basic implementation options for number portability. With the call forwarding option the call is routed as before the number porting, but then is forwarded to the customer's new location using standard call forwarding software. With the call drop back option (also called Query on Release) the calling party network checks with the network that hosts the phone number (the called party's old network provider) and obtains the new route for the call. The third option is a centralized database.

H. Customer Access to Information

As we explain in section II B 3 – Lack of Customer Information, limited customer access to information about service providers can limit competition because customers must incur costs to learn. Regulators might address this issue in three ways. One approach is to provide customers with information on service providers. Regulators might do this by providing consumers with information on prices, and information on service complaints, or service quality data. A second approach is to provide consumers with educational materials on how they can go about obtaining such information on service providers. Lastly, regulators might require operators to provide information to consumers. For example some regulators have required operators to provide every consumer with the lowest price service option that the consumer could obtain. Regulators have also required service providers to advertise or send notices to consumers whenever prices change.

I. Removal of Other Barriers to Entry and Competition

In addition to the remedies for inadequate competition already discussed, there are instances where policy makers and regulators can directly remove barriers to entry and competition. Licensing restrictions are directly under the control of a ministry, a regulator, or both. Despite the conventional wisdom in some countries that licensing restrictions benefit customers by stabilizing markets and ensuring that service providers are qualified, we are aware of no empirical evidence that customers or the economy benefit from licensing restrictions. Indeed empirical research on telecommunications consistently finds that more competition is better for customers than less competition. (Jamison, 2007b)

There may also be situations where policy makers can improve capital markets in their countries. This work is typically beyond the jurisdiction of a telecommunications regulator, but the telecommunications regulator would generally be in a position to provide evidence of the consequences of poor capital markets.

The regulator might also investigate market performance in search of evidence that operators are engaging in price fixing or dividing the market. We describe in section II D – Conduct Issues, conditions under which these anticompetitive actions are more likely to occur.

Lastly, the regulator might adopt rules that prohibit operators from hindering competition by obtaining and using information from rivals. This would be most appropriate in instances where an operator is providing essential facilities or equal access to downstream rivals.

J. Retail Regulation

There are times where retail regulation may be the regulator's best option for improving market outcomes. Situations where this could be true include instances where the regulator is unable to remove barriers to competition or at least is delayed in doing so, competition is developing but has not yet advanced to the point where it has sufficiently diminished operator market power, and instances of collusion. We cover methods of constraining market power through price controls in this section.

1. Price Cap Regulation

Price cap regulation is a form of regulation that formally limits the link between the cost an operator reports that it incurs to provide a service and the revenue the regulator allows the operator to receive from the service. More formally price cap regulation allows the operator to change its price level according to an index that is typically comprised of an inflation measure, *I*, and a "productivity offset," which is more commonly called the *X*-factor. With pure price caps, the regulator never directly observes the operator's profits. This form of price caps is rare and indeed may never be practiced. Typically with price cap regulation, prices are initially set by the regulator to allow the operator to cover its cost of capital. Thereafter, prices are allowed to rise, on average, at the rate of inflation, less an offset, namely

$$\%\Delta p \leq I - X,$$

where $\%\Delta p$ is the average percentage change in prices allowed in a year. The key issues are determining the measure of inflation and also the "offset", and, determining what it means to allow prices to rise on average. (Sappington, 2002)

The most appropriate measure of inflation is the general level of inflation for the economy because this represents how the average firm in the economy is doing with respect to its increases in costs. Using this inflation measure allows the regulator to choose an *X*-factor that reflects the difference between the telecommunications operator and the average firm in the economy with respect to how input prices are changing and how productivity is changing. (Bernstein and Sappington, 2000) In instances where the regulator lacks data on how costs are changing for the average firm in the economy the regulator can use financial models to estimate the telecommunications operator's likely cost changes and how these might relate to inflation. (Jamison, 2007a)

Typically with price cap regulation, the regulator groups services into price or service baskets and establishes an $I - X$ index, called a price cap index, for each basket. Services that the regulator wants to protect from price increases or decreases relative to certain other services are placed in a separate basket. For example, if the regulator does not want the operator to be able to raise prices for residential consumers to make up for a price decrease for business customers, the regulator would put the two sets of services in separate baskets. (Sappington, 2002; Jamison, 2007a) Regulators may also create sub-baskets within a basket to create additional restrictions on an operator's ability to change relative prices. For example, the regulator may apply a restriction of *I*-5 to all voice services and a sub-restriction of *I*-3 to prepaid cards. In this case, the company's average overall price level for voice services would need to decrease 5 percent in real terms and prepaid card prices would have to decrease 3 percent in real terms. (Jamison, 2007a)

Price cap regulation can be an effective means for regulating retail prices as competition develops because it limits opportunities for cross subsidization and for targeting price decreases to entry points for rivals. Price cap regulation limits opportunities for cross subsidization because

the weak link between what the operator spends and what the operator receives in revenue decreases the incentive to engage in cost shifting in the operator's accounting records. This form of regulation limits opportunities to target price decreases to entry points if the regulator puts prices in these most potentially competitive markets in baskets separate from other prices. This separation of prices into different baskets means the operator would have to bear the full cost of its targeted price decreases.

2. Price Floors

Regulators sometimes use price floors for competitive services where regulators want to ensure that the competitive services are not being subsidized or decreased to anticompetitive levels. Price floors are generally based on imputation (explained below) or measures of incremental cost, typically TSLRIC. Imputation price floors are used to ensure that incumbents do not hinder competition by pricing their competitive services high compared to non-competitive inputs. Price floors based on incremental cost are used based on the belief that prices are free of subsidies as long as they exceed incremental costs.

3. Imputation

Imputation is essentially an application of the ECPR or Retail Minus, but in reverse. An imputation test says that the prices an operator receives from a competitive or nearly competitive service, and for which the operator provides essential facilities to its rivals, cannot generate revenue that is less than the revenue the operator would receive selling essential inputs rather than retail services, plus the extra costs of being a retail service provider. The imputation test formula is:

Retail revenue ≥ [Wholesale price + [Retail TSLRIC – Wholesale TSLRIC]] x Quantity sold

To illustrate the application of this formula, assume the vertically integrated firm would receive 1.8 million Baht selling an essential input to its rivals. Further assume that the cost of providing the essential input would be 1.1 million Baht and the cost of serving the retail customers directly would be 1.3 million Baht. Then the imputation test states that retail prices that the vertically integrated firm should charge should it serve these customers directly should generate at least 2 million Baht in revenue.

4. Net Revenue Test

The net revenue test compares changes in revenue to changes in cost that would result from selling a service to a customer, or not selling the service to a customer. This test can result in cross-subsidization and predatory pricing in some situations; for example, when the test is applied to parts of a service rather than the total service. An alternative to the Net Revenue Test is to apply the test's principles to non-competitive services, such as the cost-based price caps. Basically, the regulator ensures that non-competitive services cover only their direct costs and some reasonable amount of shared costs, thus providing a cost-based price cap for non-competitive services. (Jamison, 2002b) This cap puts to rest any cross-subsidization concerns because prices for non-competitive services cannot be increased unless their own costs increase. The service provider is forced to be more cognizant of its costs and competitive market losses just as any of its competitors are.

IV. Conclusion

In this paper we have described the goal of workable competition, market features and operator conduct that might prevent markets from being workably competitive, and steps that regulators might take to remedy such situations.

A critical point that we make throughout this paper and that is worth repeating is that the purpose of regulatory intervention is to move market outcomes closer to the competitive outcome, not to alter or in some way fix the competitive outcome. If regulators choose to try to somehow improve upon the competitive outcome, then they are likely to fall into the litany of regulatory inconsistencies and loss of customer benefits that Professor Kahn describes for U.S. regulators in his book *Letting Go: Deregulating the Process of Deregulation*. (Kahn, 1998)

References

Adams, Peter. 2008. "Factors Affecting Broadband Adoption for Mainstream Consumers." In *Handbook of Research on Global Diffusion of Broadband Data Transmission*, Yogesh K. Dwivedi, Anastasia Papazafeiropoulou, and Jyoti Choudrie, eds. Hershey, Pennsylvania: Information Science Reference, pp. 306-320.

Allen, Bruce T. 1971. "Vertical Integration and Market Foreclosure: The Case of Cement and Concrete," *Journal of Law and Economics* 14(1): 251-274.

Areeda, Phillip, and Donald Turner. 1975. "Predatory Pricing and Related Practices under Section 2 of the Sherman Act," *Harvard Law Review* 88(4): 697-733.

Armstrong, M., and C. Doyle. (no date). "Access Pricing, Entry and the Baumol-Willig Rule." Discussion Paper No. 9422, University of Southampton.

Aron, Debra J., and David E. Burnstein. 2003. "Broadband Adoption in the United States: An Empirical Analysis." Social Science Research Network. http://ssrn.com/abstract=386100. (accessed September 5, 2007).

Baumol, William J. 1979. "Minimum and Maximum Pricing Principles for Residual Regulation." *Eastern Economics Journal*, 5: 235-48.

Baumol, William J. 1982. "Contestable Markets: An Uprising in the Theory of Industry Structure." *The American Economic Review* 72(1): 1-15.

Bernstein, Jeffrey I., and Sappington, David E. M. 2000. "How to Determine the *X in RPI - X* Regulation: A User's Guide." *Telecommunications Policy* 24(1): 63-68.

Blair, Roger D., and David L. Kaserman. 1985. *Antitrust Economics*. Homewood, Illinois: Richard D. Irwin, Inc.

Blair, Roger, and Christine Piette. 2005. "The Interface of Antitrust and Regulation: Trinko." *The Antitrust Bulletin*, 50(4):665-85.

Blowers, Alex. 2007. "Functional Separation – The UK 'Openreach' Model." Presentation at ANACOM's 10th Seminar, Lisbon, Portugal. (Available at http://www.anacom.pt/content.jsp?contentId=562609. Accessed 4 March 2008)

Bolter, Walter G. 1978. "The FCC's Selection of a 'Proper' Costing Standard after Fifteen Years – What Can We Learn from Docket 18128?" In *Accessing New Pricing Concepts in Public Utilities*, ed. Harry Trebing, 333-72. East Lansing: Michigan State University Press.

Brock, Gerald W. 1981. *The Telecommunications Industry: The Dynamics of Market Structure*. Cambridge and London: Harvard University Press.

Brown, Stephen J., and David S. Sibley. 1986. *The Theory of Public Utility Pricing.* Cambridge: Cambridge University Press.

Clark, John Maurice. 1940. "Toward a Concept of Workable Competition," *American Economic Review*. 30(2):241- 256.

Coase, Ronald H. 1937. "The Nature of the Firm," *Economica* 4(16): 386-405.

Computer Science and Telecommunications Board (CSTB). 2006. "Renewing U.S. Telecommunications Research." Robert W. Lucky and Jon Eisenberg, Editors, Committee on Telecommunications Research and Development, National Research Council, Washington, D.C.: The National Academies Press.

Crum, Roy L., and Itzhak Goldberg. 1998. *Restructuring and Managing the Enterprise in Transition*. Washington, D.C.: The World Bank.

Cubbin, John, and Jon Stern. 2006. "The Impact of Regulatory Governance and Privatization on Electricity Industry Generation Capacity in Developing Economies." *The World Bank Economic Review*, 20(1): 115-41.

DeGraba, Patrick. Undated. "Efficient Inter-carrier Compensation for Competing Networks When Customers Share the Value of a Call," Working Paper, U.S. Federal Trade Commission.

DiLorenzo, Thomas J. 1992. "The Myth of Predatory Pricing," *The Cato Institute*, Washington, D.C.

Estache, Antonio, Martín Rodríguez Pardina, José María Rodríguez, and Germán Sember. 2003. "An Introduction to Financial and Economic Modeling for Utility Regulators." World Bank Policy Research Working Paper, Washington, D.C.

Faulhaber, Gerald R. 1975. "Cross-Subsidization: Pricing in Public Enterprises." *The American Economic Review*, 65(5): 966-77.

Fowler, M. S., A. Halprin, A., and J.D. Schlicting. 1986. "Back to the future: A model for Telecommunications." *Federal Communications Law Journal*, 38(2): 145–200.

Gabel, David. 1994. "Competition in a Network Industry: The Telephone Industry, 1894-1910." *The Journal of Economic History,* 54(3): 543-572.

Glaeser, Martin. 1927. *Outlines of Public Utility Economics*. New York: The Macmillan Company.

Gutiérrez, Luis H. 2003. "The Effect of Endogenous Regulation on Telecommunications Expansion and Efficiency in Latin America." *Journal of Regulatory Economics,* 23(3): 257-86.

Hauge, Janice, and Mark Jamison. 2009. "Analyzing Telecommunications Market Competition: Foundations for Best Practices," University of Florida, Department of Economics, PURC Working Paper.

Hausman, Jerry A. and J. Gregory Sidak. 1999. "A Consumer-Welfare Approach to the Mandatory Unbundling of Telecommunications Networks." *The Yale Law Journal*, 109: 417-505.

Horngren, Charles T., Gary L. Sundem, and William O. Stratton. 2005. *Introduction to Management Accounting*, 13th Edition. Upper Saddle River: Pearson Prentice Hall.

Horwitz, Robert Britt. 1989. The Irony of Regulatory Reform: The Deregulation of American Telecommunications. New York, New York: Oxford University Press.

Jamison, Mark A. 1988. "Applying Part X Allocations to Intrastate Costs." Presented at the Fourteenth Annual Missouri Rate Symposium, Kansas City, MO.

Jamison, Mark A. 1999. *Industry Structure and Pricing: The New Rivalry in Infrastructure*, Boston: Kluwer Academic Publishers.

Jamison, Mark A. 2002a. "Competition in Networking: Research Results and Implications for Further Reform." *Michigan State University Law Review*, 3(1):621-40.

Jamison, Mark A. 2002b. "The Role of Costing as a Ratemaking Tool in an Environment of Dynamic Change." In *The Institutionalist Approach to Public Utilities Regulation*, ed. Edythe Miller and Warren J. Samuels, 250-75. East Lansing: Michigan State University Press.

Jamison, Mark A. "Effects of Prices for Local Network Interconnection on Market Structure in the US." In *Global Economy and Digital Society*, Chapter 16, Elsevier Science, 2004.

Jamison, Mark A. 2006. "Cost Concepts for Utility Regulators," University of Florida, Department of Economics, PURC Working Paper.

Jamison, Mark A. 2007a. "Regulation: Price Cap and Revenue Cap." In *Encyclopedia of Energy Engineering and Technology Vol. 3*, ed. Barney Capehart, 1245-51. New York: CRC Press, Taylor and Francis.

Jamison, Mark A. 2007b. "The 1st Academic Conference on the Auspicious Occasion of His Majesty the King's 80th Birthday Anniversary: The Importance of Telecommunications Development." In *NTC Annual Review 2007* Vol. 1, 58-87. Bangkok: National Telecommunications Commission of Thailand.

Jamison, Mark A., and David Brevitz. 1987. "New Techniques for Segregating Costs between Regulated and Unregulated Services and between Different Common Carrier Services." In *New Regulatory and Management Strategies in a Changing Market Environment*, ed. Harry M. Trebing and Patrick C. Mann, 252-80. East Lansing: Michigan State University Public Utilities Papers.

Jamison, Mark A., Robert Gee, Robert Rowe, and Brett A. Perlman. 2006. "Disbanding the Maryland PSC." University of Florida, Department of Economics, PURC Case Study.

Jamison, Mark, and James Sichter. 2008. "U.S. Experiences with Business Separation in Telecommunications." PURC Working Paper, Department of Economics, University of Florida.

Kahn, Alfred E. 1988. *The Economics of Regulation: Principles and Institutions*. Cambridge: The MIT Press (Reissue Edition).

Kahn, Alfred E. 1998. *Letting Go: Deregulating the Process of Deregulation*. East Lansing, Michigan: The Institute of Public Utilities and Network Industries.

Kahn, Alfred E., and William B. Shew. 1987. "Current Issues in Telecommunications: Pricing." *Yale Journal on Regulation*, 4(2): 191-256.

Kahn, Alfred, and William Taylor. 1994. "The Pricing of Inputs Sold to Competitors: A Comment." *Yale Journal on Regulation* 11: 225-240.

Kim, Eun-Ju. 2003. "Reference to Competition: Overview," International Telecommunications Union, http://www.itu.int/ITU-D/treg/Events/Seminars/2003/Mongolia/21-Reference%20-%20Competition-Overview.pdf (accessed May 11, 2008).

Laffont, Jean-Jacques. 2005. *Regulation and Development*. Cambridge, U.K.: Cambridge University Press.

Laffont, Jean-Jacques, and Jean Tirole. 1996. "Creating competition through interconnection: Theory and practice," *Journal of Regulatory Economics* 10(3): 227-256.

Laffont, Jean-Jacques, and Jean Tirole. 2000. Competition in Telecommunications. Cambridge and London: The MIT Press.

Larson, Alexander C. 1989. "Cost Allocations, Predation, and Cross-Subsidization in Telecommunications." *The Journal of Corporate Law*, 14(2): 377-398.

Larson, Alexander C., and Steve G. Parsons. 1995. "'Building Block' Cost Methods for Pricing and Unbundling Telecommunications Services: Implications for the Law and Regulatory Policy." *Jurimetrics Journal*, 36(1): 59-97.

Lee, Sangwon, and Mircea I. Marcu. 2007. "An Empirical Analysis of Fixed and Mobile Broadband Diffusion." University of Florida, Department of Economics, PURC Working Paper.

Leibenstein, Harvey. 1966. "Allocative Efficiency vs. 'X-Efficiency'." *American Economic Review* 56(3): 392-415.

Lieberman, Marvin B. and David B. Montgomery. 1988. "First-Mover Advantages." *Strategic Management Journal* 9(Special Issue: Strategy Content Research, Summer, 1988): 41-58.

Lyon, Thomas, and Jing Li. 2003. "Regulatory Uncertainty and Regulatory Scope." Indiana University, Kelley School of Business, Unpublished.

Mas-Colell, Andreu, Michael D. Whinston, and Jerry R. Green. 1995. *Microeconomic Theory*. Oxford: Oxford University Press.

Mialon, Sue H. 2005. "Pricing Access in Network Competition," Emory University and University of North Dakota working paper. Available at SSRN: http://ssrn.com/abstract=664841.

Mitchell, Bridger, Werner Neu, et al. 1995. "The Regulation of Pricing of Interconnection Services." (unpublished paper).

NERA and Smith. 1998. "Feasibility Study & Cost Benefit Analysis of Number Portability for Mobile Service in Hong Kong." Unpublished report.

Panzar, John C., and Robert D. Willig. 1981. "Economies of Scope." *American Economic Review*, 71(2): 268-72.

Park, Minjung. 2008. "The Economic Impact of Wireless Number Portability." Working Paper, Department of Economics, University of Minnesota.

Pitofsky, Robert. (undated) "The Essential Facilities Doctrine under United States Antitrust Law." Georgetown University Law Center. Available at http://www.ftc.gov/os/comments/intelpropertycomments/pitofskyrobert.pdf, downloaded July 8, 2008.

Potter, Gordon, Wayne J. Morse, James R. Davis, and Al L. Hartgraves. 2006. *Managerial Accounting*, Fourth Edition. Downers Grove: Cambridge Business Publishers.

Sappington, David E.M. 2002. "Price regulation." In *Handbook of Telecommunications Economics*; Cave, Martin E., Majumdar, Sumit K., and Vogelsang, Ingo, Eds. North-Holland: Amsterdam, Vol. 1, 227-293.

Shapiro, Carl and Hal R. Varian. 1999. *Information Rules: A Strategic Guide to the Network Economy*. Boston, MA: Harvard Business School Press.

Sharkey, William W. 1982. *The Theory of Natural Monopoly.* Cambridge: Cambridge University Press.

Shenefield, John H., and Irwin M. Stelzer. 2001. *The Antitrust Laws: A Primer*. Washington, D.C.: The American Enterprise Institute.

Shepherd, William G. 2004. "Access Pricing, Innovation, and Effective Competition," Address to ACCC Conference, Gold Coast, Australia, http://www.atug.org.au/other/ACCCWilliamShepherdSpeech.pdf (accessed May 11, 2008).

Smith, Vernon. 1971. "The Borrower-Lender Contract Under Uncertainty," *Western Economic Journal* 9(1): 52-56.

Sosnick, Stephen H. 1968. "Toward a Concrete Concept of Effective Competition." *American Journal of Agricultural Economics* 50(4): 827-853.

Spiller, Pablo T. 2005. "Institutional Changes in Emerging Markets: Implications for the Telecommunications Sector." In *Handbook of Telecommunications Economics: Volume 2*, ed. Sumit K. Majumdar, Ingo Vogelsang, and Martin E. Cave, 621-655. Amsterdam: North-Holland.

Stigler, George J. 1956. "Report on Antitrust Policy: Discussion," *American Economic Review*. 46(2):504-507.

Tirole, Jean. 1997. The Theory of Industrial Organization. Cambridge: The MIT Press.

Trebing, Harry M. 1984. "Public Control of Enterprise: Neoclassical Assault and Neoinstitutionalist Reform." *Journal of Economic Issues*, 18(2): 353-68.

Tye, William. 1994. "The Pricing of Inputs Sold to Competitors: A Response." *Yale Journal on Regulation* 11:203-224.

Viscusi, W. Kip, John M. Vernon, and Joseph E. Harrington, Jr. 2001. *Economics of Regulation and Antitrust,* 3rd Edition, Cambridge: The MIT Press.

Wallsten, Scott J. 2004. "Privatizing Monopolies in Developing Countries: The Real Effects of Exclusivity Periods in Telecommunications." *Journal of Regulatory Economics*, 26(3): 303–320.

Waverman, Leonard, Meloria Meschi, and Melvyn Fuss. 2005. "The Impact of Telecoms on Economic Growth in Developing Countries." *The Vodafone Policy Paper Series*, 3: 10-23.

Weisman, Dennis L. 2000. "The (In)Efficiency of the 'Efficient-Firm' Cost Standard." *Antitrust Bulletin*, 45(1): 195-211.

Williamson, O.E. 1971. "The Vertical Integration of Production: Market Failure Considerations," *American Economic Review* 61(2): 112-123.

Williamson, O.E. 1974. "The Economics of Antitrust: Transaction Cost Considerations," *University of Pennsylvania Law Review* 122(6): 1439-1496.

Willig, Robert. 1979. "The Theory of Network Access Pricing." In *Issues in Public Utility Regulation*, H. Trebing, ed., East Lansing, Michigan: Institute of Public Utilities, pp. 109–152.

Appendix A

Summary of the FCC's policies on calculating avoided costs.

A. Avoided cost includes all of the costs that the ILEC (incumbent local exchange company) incurs in maintaining a retail service, as opposed to a wholesale, business; i.e., states to make an objective assessment of what costs are reasonably avoidable when a LEC sells its services wholesale.

B. "Reasonably avoidable" includes indirect, or shared, costs as well as direct costs. This is because indirect or shared costs, such as general overheads, support all of the LEC's functions, including marketing, sales, billing and collection, and other avoided retail functions. The FCC explained that "It is true that expenses recorded in indirect or shared expense accounts will continue to be incurred for wholesale operations. It is also true, however, that the overall level of indirect expenses can reasonably be expected to decrease as a result of a lower level of overall operations resulting from a reduction in retail activity."

C. A portion of contribution, profits, or mark-up may also be considered "attributable to costs that will be avoided" when services are sold wholesale.

D. A study may <u>not</u> calculate avoided costs based on non-cost factors or policy arguments. For example, the effects on facilities-based competition, the viability of the reseller's business, the propriety of external relations or research and development costs, and deficiencies in the provisioning of wholesale services may not be considered.

E. Studies may use TSLRIC or embedded costs to identify the portion of a retail rate that is attributable to avoided retail costs.

F. States may apply either a single, uniform discount rate for all of an ILEC's services or individual discounts.

G. If embedded costs are used:

- All costs recorded in accounts 6611 (product management), 6612 (sales), 6613 (product advertising), 6623 (customer services), 6621 (call completion services), and 6622 (number services) are also presumed avoidable unless an ILEC proves that specific costs in these accounts will be incurred with respect to wholesale services, or that costs in these accounts are not included in the retail prices of the resold services.

- General support expenses (accounts 6121-6124), corporate operations expenses (accounts 6711, 6612, 6721-6728), and telecommunications uncollectibles (account 5301) are presumed to be avoided in proportion to the avoided direct expenses identified in the previous paragraph.

- Plant-specific and plant non-specific expenses (other than general support expenses) are presumptively not avoidable.

Descriptions of the FCC's accounting rules can be found at http://www.access.gpo.gov/nara/cfr/waisidx_07/47cfr32_07.html.