

Barriers to Entry Analysis of Broadband Multiple Platforms: Comparing the U.S. and South Korea

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Abstract

This paper compares barriers to entry in the broadband markets between the U.S. and South Korea. First, it explores economic conceptions of barriers to entry from the economics literature. Second, it speculates on how the conception of barriers to entry has been dealt with in the telecommunications industry. It clarifies the various industrial factors that could prevent, or make it difficult, to successfully enter the residential telecommunications market. Third, it introduces an analytical framework that can be adopted for evaluating the barriers to entry. Fourth, employing that framework, it examines the broadband markets in the U.S. and in South Korea, focusing on barriers to entry in multiple broadband access platforms. Both the U.S. and South Korea have shown greater barriers to entry in wireline broadband markets such as cable modem and DSL compared to wireless broadband when it comes to a facilities-based entry. South Korea has offered more opportunity to non-dominant ISPs as new entrants and thus, has been able to facilitate more vibrant competition nationwide. This paper concludes with an analysis of the barriers to entry for alternative broadband access platforms in residential high speed Internet services, more specifically, wireless access technologies, including other economic and policy factors in the US and South Korea. The sluggish progress of intermodal and intramodal market competition explains a part of the sluggish demand in the residential high speed Internet access market in the U.S., while the South Korean market was able to grow rapidly due to fierce competition in the market, mostly facilitated by the Korean government's open access rule and policy choices more favorable to new entrants rather than to the incumbents. Furthermore, near monopoly control of the residential communications infrastructure by cable operators and telephone companies manifests itself as relatively high pricing and lower quality in the U.S. The more favorable terms from which the dominant providers have benefited, and government's deregulation, may limit business opportunities for other Internet service providers.

1. Introduction

Assessing whether or not there are entry barriers in a certain industry has been one of the critical methods for examining the presence of market power of the incumbents. Since a variety of entry barriers to a market will lead prices to increase greater than marginal cost and deter the entry of more efficient companies, it is detrimental to allocative efficiency and productive efficiency (Carlton & Perloff, 2005; Blee, et al., 2003).

When it comes to the residential broadband (or high speed Internet) market, the recent emphasis of the FCC on facilities-based competition and a series of deregulatory decisions have given rise to the debate as to whether the US competition policy (i.e., the elimination of mandated open access rules to the incumbents' networks) will result in a greater competitive advantage to the incumbents and higher barriers to entry to new entrants (Weiser & Bleha, 2005; Scott & Aaron, 2005; Cooper, 2005; Kimmelman, 2005; Besing, 2005; Bleha, 2005).

Since 1999, wired access technologies such as fiber and broadband over power line (BPL) and wireless access technologies such as Wi-Fi, WiMax¹ and satellite have been promoted as would-be competitors in the foreseeable future.² However, the residential broadband market in the U.S. is still characterized by a dominant-fringe model as identified in the narrowband telephone market (Rosenberg and Clements, 2000). It is suggested that the residential broadband market will be a dominant-fringe cluster model because of the structure of two dominant leaders in each cluster (the ILECs and cable MSOs) with smaller entrants (Zhang, 2002). The incumbent sellers will initially retain large market shares with a fringe attempting to shave away the incumbent's customers. Traditional economic literature suggests that the smaller players will be price takers and face some significant challenges in entering these markets.

Despite the significance of entry barriers, there is lack of research over how these new entrants with alternative technologies enter and serve the market and further, how the FCC's competition policy will influence these new entrants in the long run. We only guess that the impact of entry barriers would be different depending on the type of entrance, i.e., entrants with facilities and entrants without their own facilities. Also, it would be different between a pure new starter and an entrant that comes over from the other industry. Among alternative access technologies, the wireless group has the most potential because of their cost effectiveness compared to other technologies (CSTB, 2001; Zhang, 2002). The rapid adoption and expansion of service areas recently through the incumbents, wireless ISPs and municipal governments shows its possibility.

On the other hand, increasing concern about lagging behind other countries in terms of

¹ Worldwide Interoperability for Microwave Access (WiMax). WiMax allows for wireless data speeds of up to 40 Mbps over a distance of 10 kilometers. Although it requires the availability of spectrum, WiMax technology has been envisioned as complementary to Wi-Fi, playing a key role in providing long-range fixed wireless connectivity in rural and remote areas as well as mobile connectivity over shorter distances (OECD, 2006).

² The FCC divides the access technologies into five mutually exclusive categories: "Asymmetric digital subscriber line (ADSL) technologies, which provide speeds in one direction greater than speeds in the other direction; wireline technologies *other* than ADSL, including traditional telephone company high-speed services and symmetric DSL services that provide equivalent functionality; coaxial cable, including the typical hybrid fiber-coax (HFC) architecture of upgraded cable TV systems; optical fiber to the subscriber's premises (e.g., Fiber-to-the-Home, or FTTH) and electric powerline; and satellite and terrestrial wireless systems, which use radio spectrum to communicate with a radio transmitter" (FCC, 2005, p.13).

the broadband penetration rate has been also rising with many academics and research analysts (Horrigan, 2005; Bleha, 2005; Frieden, 2005a, 2005b). In particular, South Korea has been an example to look at the impact of fierce competition on a successful penetration rate in the residential broadband market. For a long time, the Korean government has enforced its unbundling mandate and line sharing rules on the incumbent network providers both in narrowband past and broadband currently. Thanks to its more favorable policy towards new entrants, South Korea has enjoyed more viable competition on both intermodal and intramodal bases compared to the U.S. (Lau, Kim and Atkin, 2005; Han, Byun & Lee, 2005; Lee & Chan-Olmsted, 2004). Thus, the key inquiry in the case of South Korea would be the size of entrance rather than the shape, for example, whether it will be a small entrance in a certain region or a nationwide entrance regardless of the presence of facilities. As a result, the size of entrance will determine entry barriers to the residential broadband market in South Korea. Despite vibrant competition between DSL and cable modems in South Korea, alternative broadband platforms such as wireless and BPL have not appeared as competitors in the market, just as in the U.S. Therefore, they have been regarded as complementary access technologies to the incumbents rather than competitive technologies (Koh, Lee, & Kim, 2005).

Based on this background information, this paper further examines whether there are barriers to entry for new entrants to enter the residential high speed Internet market in the U.S. and South Korea by applying barriers-to-entry theories derived from the industrial organization approach. In particular, the comparison of both countries will offer more insight and useful implications to policy makers and the industry than when we look only at one country in terms of broadband competition policy. It roughly reviews each broadband access platform in the U.S., with special attention to wireless technologies, and this analysis will be compared to that of South Korea.³

The research questions are as follows: Which barriers to entry exist to new entrants in the residential broadband access market?: How have these barriers to entry affected actual entry into the residential wireless broadband access market?: How are entry barriers to the U.S. broadband market different from entry barriers to the South Korea broadband market? To answer the questions, this paper employs a qualitative case study based upon data sources such as government documents, law reviews, statistical reports, news reports, scholarly theoretical works, commercial reports, etc.

This paper concludes with an analysis of the barriers to entry for alternative broadband access platforms in residential high speed Internet services, more specifically, wireless access technologies, including economic and policy factors in the US and South Korea. It found that the sluggish progress of intermodal and intramodal market competition explains a part of sluggish demand in residential high speed Internet access market in the U.S., while the South Korean market could grow rapidly due to fierce competition in the market, mostly facilitated by Korean government's open access rule and policy choices more favorable towards new entrants rather than to incumbents. Furthermore, near monopoly control of the residential communications infrastructure by cable operators and telephone companies manifests as relatively high pricing and lower quality in the U.S. The more favorable terms from which the dominant providers have benefited, and the government's deregulation, may limit business opportunities for new entrants.

³ Because of page limitation, each platform would be reviewed only briefly in this paper. Also, it should be noted that this paper is a part of a whole thesis that goes on.

The paper is organized as follows. Section 2 presents theoretical perspectives based upon economic concepts of entry barriers. The section will shed light on how the barriers-to-entry debate has been developing and which discrepancies exist in a variety of theoretical perspectives. It also reviews the existing literature that has dealt with this subject regarding the competition issue in telecommunications. A part of Section 2 considers how the telecommunications industry is different from other product industries. With these foundations about barriers to entry, Section 3 introduces an analytical framework which can be used for evaluating the existence of entry barriers in the telecommunications industry and discusses each step. Section 4 examines broadband markets in the U.S. and South Korea briefly and identifies possible entry barriers based upon the literature. The last section discusses the commonalities and differences between the two countries, and sets out the conclusions.

2. Literature Review

2.1. Historical debates on the definition of entry barriers

Entry barriers do not have any coherent and widely-accepted definition. Indeed, there is few economic terms which have as much controversy over their definition. A barrier to entry is a multifaceted term which can be defined in various ways and distinguished by many different groups: natural barriers versus artificial barriers (White, 1989), natural barriers versus strategic barriers to entry (Woroch, 1990), structural barriers versus strategic barriers (Blees, et al., 2003; McAfee et al., 2004), and more precisely, economic, antitrust, standalone and ancillary barriers (McAfee et al., 2004).⁴ Also, it can be viewed from the perspective of the entering firm and from the perspective of incumbent firms. Historically various viewpoints have kept their own perspectives different from one another in light of structural features, entry impacts on market performance and the value of incumbency. The historical explanation about the term can be found in McAfee et al. (2004) and in Geroski, et al. (1990) in more detail (see table 1).

Table 1. Various definitions of barriers-to-entry

Scholars	Emphasis	Features
Bain (1956)	-Anything that allows incumbent firms to earn above-normal profits without the threat of entry.	-Failure to articulate a consistent theory -positive
Stigler (1968)	-Differential costs between the incumbents and new entrants	-Narrower than Bain's definition; Far stricter -positive
Ferguson (1974)	-The incumbents' ability to set prices above marginal cost and to earn monopoly return	Advertisements are not a barrier depending on a case.
Fisher (1979)	-Anything that prevents entry when entry is socially beneficial.	-Accepting Bain's and Ferguson's definition.

⁴ To date, barriers-to-entry has been discussed in two different, sometimes overlapping streams of literature: industrial organization and strategic management (Blees et al., 2003). Strategic management literature takes the perspective of individual companies and describes what they can do to enhance their performance. Although the strategic-management literature contributes to the understanding of the rationale behind the strategic actions of companies to create barriers to entry, this paper is more interested in the whole telecommunications industry rather than individual firm's strategic actions. Therefore, most literature reviewed here was derived from the industrial organization model of the structure-conduct-performance framework even though these theoretical underpinnings have been criticized for their intrinsic defects (Carlton, 2005).

	-Incumbents' unnecessarily high profits without entry	-Normative -an initial capital requirement not a barrier
Von Weizsacker (1980)	-Differential costs between incumbents and entrants -Any advantage over an entrant that an incumbent firm enjoys <i>if that advantage produces a welfare loss</i> .	-Based on Stigler's definition -Normative definition -Only if its consequences are undesirable, the advantage is a barrier to entry.
Baumol, Panzar & Willig (1982)	-anything that reduce the sum of consumers' and producers' surplus, while phenomena such as fixed costs and scale economies deed not do so (p.282).	-Incumbents can have costs lower because of the superior efficiency. -Such a cost difference is not a barrier to entry.
Gilbert (1989)	-A rent derived from incumbency	-Defining entry barriers from the perspective of incumbents -Sunk costs: both a barrier to exit and a barrier to entry
Carlton & Perloff (1994)	-Both costs of entering and the time required to enter	-Incorporates a time dimension -Based on Stigler's definition
Church & Ware (1999)	-A structural characteristic of a market that protects the market power of incumbents by making entry unprofitable	-Distinguish between structural and strategic barriers -Only structural barriers are barriers to entry
McAfee, Mialon & Williams (2004)	Distinguishing the concept of barriers to entry into <i>economic, antitrust, standalone, and ancillary</i> ones	More precise and sophisticated distinctions

Source) Adapted from McAfee, et al. (2004), Baumol, Panzar & Willig (1982)

2.2. Bain's structural barriers and Stigler and Chicago school's barriers

In the economic literature, the most controversial distinction has been whether the definition of a barrier to entry follows either Bain's or Stigler's. To put it simply, the concept of barriers to entry has been defined differently based on whether it focuses on above-normal profits of incumbents or cost difference between incumbents and new entrants. The conception of barriers to entry in the industrial organization literature goes back to Bain (1956). He focused on the consequences of barriers to entry, i.e. a higher price than the price hypothetically attributed to long-run equilibrium in pure competition. Bain (1956) defined it as follows:

A barriers-to-entry is an advantage of established sellers in an industry over potential entrant sellers, which is reflected in the extent to which established sellers can persistently raise their prices above competitive levels without attracting new firms to enter the industry (p.3).

Based upon this definition, Bain identified important market characteristics that can have significant effect on the condition of entry: *economies of scale, capital requirements, absolute cost advantages, and differentiation advantages* (Bain, 1956). However, a slightly different perspective in the industrial-organization literature (Chicago school) looks at the costs that must be borne by an entrant to a market that need not be borne by an incumbent already operating in the market (*asymmetry of costs*). Emphasizing differential costs between incumbents and new entrants, this perspective was initiated by George S. Stigler. He rejected Bain's basic contention that scale economies and capital requirements are barriers to entry, and developed his own definition, below.

A barriers-to-entry is a cost of producing (at some or every rate of output) which must be borne

by firms which seek to enter an industry but is not borne by firms already in the industry (Stigler, 1968, p.67).

This implies that the incumbents and entrants are not equally efficient after the costs of entering are taken into account (i.e., the conditions for entering for the incumbents were less difficult than for later entrants). A barrier to entry exists only if the potential entrant's long-run costs after entry are greater than those of the incumbent. The practical distinction between the two definitions lies in the way economies of scale are treated as a barrier to entry. In Bain's definition, economies of scale are a barrier to entry because entry will lead to a price reduction and the post-entry profits are likely to be lower than the incumbents' pre-entry profits. In the Stigler definition, scale economies do not represent a barrier to entry if they imply penalties from sub-optimal levels of production that are the same for the incumbents and the entrant. In any given industry, entrants and incumbents enjoy the same scale economies as they expand their output. With equal access to technology, therefore, economies of scale are not a barrier to entry according to Stigler (McAfee, et al., 2004). Also, advertising and capital requirements create barriers for Bain because they seem correlated with high profit rates, but so long as these inputs are available on equal terms to all who wish to employ them, they create no barriers for Stigler (Demsetz, 1982, p.48).

Table 2. Bain's and Stigler's definitions of entry barriers

	Barriers	Bain's definition	Stigler's definition
<i>Structural</i> barriers to entry	Economies of scale	O	X
	Switching costs	O	O
	Brand loyalty	O	O
	Capital costs	O	X
	Absolute cost advantages	O	O
	Informational advantages	O	Δ
	Organizational advantages	O	X
	Asset specificity	O	O
	Patent, intellectual property	O	X
	Regulatory barrier (license)	O	Δ
	Essential facilities	O	X
<i>Strategic</i> barriers to entry	Intense advertising	O	X
	Sunk costs	O	X
	R&D costs	O	X
	Reputation	O	X
	Contracts to block distribution	O	O
	Excess capacity	O	X
	Price discrimination	O	X
	Tying	O	X
	Collective product proliferation	O	X
	Lobbying to raise entrant's cost	O	X
	Exclusive patent cross-licensing	O	X
	Vertical foreclosure	O	O
	Predatory behaviors	O	X

Source) Kim & Lee (2005) O a barrier to entry Δ depends on the situation X not a barrier to entry

On the other hand, the Stiglerian conception of entry barriers is based on a powerful analytic point: entry barrier analysis should distinguish desirable from undesirable entry. If prospective entrants face precisely the same costs that incumbents faced but still find entry unprofitable, then this market has probably already attained the appropriate number of players,

even though monopoly profits are being earned. In this case, the socially desirable solution to the problem of oligopoly performance in this market is not to force entry of a further number of entrants but rather to look for alternative measures that make collusion more difficult (Hovenkamp, 1999, p.40).

As shown in the table 1, the various definitions of barriers to entry can be distinguished into Bain's (Bain, Ferguson, Fisher and Gilbert) and Stigler's definition (Stigler, von Weizsacker, Carlton and Perloff) (Table 2). In theoretical perspective, Stigler's definition is more sophisticated than Bain's. Thus, it has been widely accepted in the dominant definition of a barrier to entry in the economics literature. It should be noted, however, that the real application in competition policy has adopted Bain's definition more widely than Stigler's. Bain's definition has been incorporated in the Horizontal Merger Guidelines of the Department of Justice (DOJ) and the Federal Trade Commission (FTC). Excluding some exceptions, most of the U.S. antitrust cases have been based upon Bain's approach (Hovenkamp, 1999). Hovenkamp (1999) suggests that the reason for this wider acceptance of Bain's definition is that Bain's approach is more likely to be free of the value judgment of what constitutes socially desirable entry (Hovenkamp, 1999, p.40).

This paper incorporates Bain's approach rather than Stigler's approach because the Bain's approach could consider much broader industrial factors which make new entry difficult and also allow incumbents to wield their market power by setting up prices above the competition level. On this occasion, the Stigler's definition would be much more strict and narrow despite its precision. For example, economies of scale, advertising and capital requirements cannot be barriers under Stigler's conception; otherwise they would be barriers under Bain's range of barriers. Indeed, every possible market factor that can produce a profit difference could belong to barriers to entry according to Bain (table 2).

On the other hand, McAfee, Mialon & Williams (2004) distinguished entry barriers into four different groups to avoid the confusion caused by the various definitions above: economic, antitrust, standalone, and ancillary barriers. These groups embrace both Bain's and Stigler's approach altogether into a barriers-to-entry model. While agreeing on the difficulty of measuring the variables, they have been successful at catching all plausible barriers for consideration as avoiding unnecessary controversy.

According to their categorization, scale economies are ancillary barriers to entry that reinforce other barriers to entry such as customer switching costs and brand loyalty. A standalone barrier to entry is a cost that constitutes a barrier to entry by itself. For example, brand loyalty, absolute cost advantage, price discrimination, tying and lobbying to raise entrants' costs. An ancillary barrier to entry refers to a cost that reinforces other barriers to entry if they are present, such as economies of scale, capital costs and informational advantage. For example, scale economies can reinforce customer switching costs and brand loyalty. An economic barrier to entry is a cost that must be incurred by a new entrant and that incumbents have not had to incur, or a cost-time tradeoff that must be faced by a new entrant and that is less favorable to the new entrant than it was to incumbents when they entered the market. An antitrust barrier to entry is a cost that delays entry, and thereby reduces social welfare relative to immediate but equally costly entry. According to the distinction of McAfee et al. (2004), structural barriers and strategic barriers can be categorized into either economic barriers or antitrust barriers respectively. Economic and antitrust barriers can be distinguished into either standalone or ancillary barriers as well (table 3). Thus, these definitions are more comprehensive and precise as

they embrace various definitions discussed in the previous literature.

Table 3. Classification of entry barriers by McAfee et al. (2004)

		Economic barriers to entry		Antitrust barriers to entry	
		Standalone	Ancillary	Standalone	Ancillary
Structural barriers to entry	Economies of scale				○
	Switching costs			○	
	Brand loyalty	○		○	
	Capital costs				○
	Absolute cost advantages	○		○	
	Informational advantages				○
	Organizational advantages		○		○
	Asset specificity		○	○	
Strategic barriers to entry	Intense advertising			○	
	Contracts to block distribution			○	
	Excess capacity		○	○	
	Price discrimination	○		○	
	Leave-only marketing		○	○	
	Tying	○		○	
	Collective product proliferation				○
	Lobbying to raise entrant's cost	○		○	
Exclusive patent cross-licensing		○	○		

On the contrary, Carlton (2005) points out that Bain's conception of entry barriers is based on an incorrect theoretical footing of a simple structure-conduct-performance framework. Stigler also paid no attention to dynamics or sunk costs and only focused on the long-run steady state. Carlton suggests, therefore, that the conception of entry barriers has to incorporate a time dimension and market dynamics in barriers to entry models such as adjustment costs, sunk costs and uncertainty in the market. Even though these variables are hard to measure, this model embraces more realistic dimensions. We incorporate Carlton's insights into an evaluative framework for assessing barriers to entry in a market, which will be addressed in the following section.

In sum, the previous economic literature has discussed which industrial factors should be included as barriers to entry in general terms. In particular, most of these studies have focused on which industry has more (or higher) barriers compared to other industries (Bain, 1956; Schmalensee, 1989; Carlton & Perloff, 2005). Important as it is in many antitrust contexts to go beyond the Bain and Stigler definitions to take into account the dynamics of entry (as Carlton, 2005 and McAfee et al., 2004), economists unfortunately seem to have produced very little potentially relevant theory and essentially no systematic empirical analysis of factors that slow entry. They also fail to articulate which barriers are more important compared to other barriers in an industry, although the importance of barriers in deterring entry of competitors into markets varies by products and industries (Karakaya and Stahl, 1989; Yang, 1998). The effect of a structural industry factor on entry will vary enormously across industries as well. Thus, to further elucidate the presence of barriers to entry, the contextual factors of an industry should be considered. In particular, the telecommunications market featuring two-way networks and

network externalities (Economides and White, 1994) has been described as having a distinguished structure and its own barriers. An important feature of networks (and of services provided over networks) is that they are typically composed of various complementary components that are combined to create composite goods (or systems) that are substitutes for each other. Thus, traditional approaches that dealt exclusively with substitutes or complements fail, and new theoretical and empirical analysis are required (Economides, 1996). Furthermore, given the importance of a time dimension and contextual factors emphasized by Carlton (2005), a case study would be appropriate to integrate them into the evaluation of barriers to entry. Next section outlines the unique features of telecommunications market and how these features are relevant to broadband access.

2. 3. Barriers to entry in the telecommunications market

Explicitly identifying the presence of barriers to entry and their characteristics is very important not only for the systematic evaluation and prediction of market competition but also for imposing a priori obligations on the incumbents with market power and establishing a proper competition policy.

Telecommunications networks can be characterized by high threshold levels of investment, which causes the existence of substantial sunk costs and a high fixed to variable cost ratio, significant economies of scale and scope, and externalities (Miller, 1995; Brock, 1981). As related in the previous discussion, economies of scale have been one of the most important features in the telecommunications network industry regardless of whether it is considered an entry barrier or not. In addition, although Stigler's definition has been well accepted among modern economists, some economists identify the scale economies as a critical barrier (Geroski, et al., 1990; Nahata & Olson, 1989; Gabel, 2002).

For instance, Gabel (2002) enumerates three sources of economies of scale in the local telecommunications market and defines the economies of scale as a critical barrier to entry. First, new entrants have to install facilities such as putting up poles, digging trenches, or laying conduit. In this case, economies of scale exist because of the high capital and construction costs that require at least a minimum scale, and would be an additional barrier to entry because the fixed costs are also sunk once the facilities are built.⁵ Second, the back office fixed cost of setting up a billing and operational support system will be a source of economies of scale. Third, the economies of scale exist in customer acquisition costs because any company incurs certain minimum expenses that are largely independent of the number of customers served such as developing an advertising and marketing campaign for a particular geographic area.

Geroski et al. (1990) argue that if economies of scale permit established firms to limit the market available to new entrants, then they are a source of entry barriers. For example, they show an example when production involves substantial sunk costs. In this way, strategy and structure may interact to create barriers and to sustain profitable operations by incumbents.

⁵ Sunk or irreversible costs deter entry because they increase the risk associated with entry. Incumbent firms have a strategic advantage if the entrant must incur costs that are not part of the forward-looking opportunity costs of the incumbent. These additional costs create a barrier to entry because the incumbent firms' opportunity costs are lower than the entrants' costs and therefore, the incumbents will be able to underprice their potential rivals (Baumol, Panzar & Willig, 1982; cited in Gabel, p.3).

Nahata & Olson (1989) empirically introduced a situation in which scale economies can act as a barrier to entry. Within the context of the Cournot model with scale economies, there exist a critical number of incumbent firms such that industry cost and demand conditions require a new firm to enter at so large a size that post-entry prices lead to economic losses. The potential entrant would not enter the market even if incumbent firms earn supra-normal profits. The conditions under which scale economies serve as a barrier to entry can be defined solely in terms of demand and cost elasticities and the number of firms in the industry. Nahata and Olson's econometric model shows that the role of scale economies in providing supra-normal profits generally diminishes as the number of firms in an industry increases. Thus, according to Nahata and Olson (1989), economies of scale will usually be a significant barrier to entry only when the critical number of firms is fairly small. Although there is no barrier in the Stigler sense of the term, scale economies provide incumbent firms with supra-normal profits and prevent the entry of one additional firm. The current residential broadband market in the U.S. seems to bear a striking similarity with this situation.

In particular, telecommunications networks are distinguished by economies of scale with sunk costs. More recently, Sidak (2006) summarizes economic characteristics of broadband networks as follows: First, a broadband network requires substantial sunk investment. The sunk investment must be made continuously over time. Second, a broadband network exhibits economies of scale. The large sunk costs of building a broadband network imply that the marginal cost of providing service to one more consumer is very low. However, marginal cost pricing is insufficient to recover even the average variable cost of the network, much less the average total cost, which would be necessary to recover the sunk costs of building the network. Third, a broadband network exhibits economies of scope. In other words, there are synergistic 'common costs' to producing multiple products over the same network. Fourth, differential pricing can increase economic welfare because it enables a firm to lower the price to consumers who would otherwise be priced out of the market if the firm were constrained to charge a higher uniform price.

A research report about barriers to entry for Small and Medium-sized Enterprise (SMEs) (Blees, et al., 2003) analyzed relevant literature and found that incumbents are the most powerful party when the height of entry barriers is concerned. This report argues that incumbents can control most influential barriers in various ways. While incumbents may raise barriers by blocking distribution channels, by increasing advertising and selling expenditures, by increasing their span of control over resources, by increasing switching cost, by aggressive or limit-pricing, by increasing excess capacity, etc., entrants may lower only one barrier, namely the brand-name barrier by aggressive marketing and advertising. However, government can influence significantly the height of certain barriers: by setting rules and regulations concerning the access to existing distribution channels, by limiting or expanding the access to essential facilities such as infrastructure and networks, and by prohibiting seller concentration (pp.138-139).

As indicated in the literature, either DSL lines or cable networks are representative telecommunications networks with substantial sunk costs, economies of scale and scope. Thus, in broadband access market, if a new entrant is going to enter into the nationwide market, barriers to entry would be very high to entrants that could not realize economies of scale. But barriers to entry would be rather lower to entrants with economies of scale compared to entrants without scale economies. Even though new access technologies, like wireless, satellite and power-line, are able to overcome some kinds of barriers inherent in the residential broadband

access market, they still need to prevail over scale economies to be profitable enough to survive in the market.

2.3.1. Determinants of market entry in local telecommunications markets

Previous literature in telecommunications has mostly discussed the determinants of market entry into local telecommunications market and there is little literature that only deals with barriers issue in the telecommunications industry. The previous studies of entry determinants, thus, will shed light on understanding which market factors will behave as entry barriers and which factors are more important than others. Understanding what industrial factors have intervened (or encouraged) a new entry will help comprehend the barriers in the residential broadband access market.

First of all, as Ford et al. (2005) indicate, two critical factors drive the entry decision: post-entry profitability and entry costs. Firms will enter a market only if it is profitable to do so. The authors identify that market size, the intensity of price competition, the level of product differentiation and the existence of rival networks will determine the post-entry profit of a new entrant. The factors that influence the post-entry profit, therefore, determine new entry. Other econometric models and empirical evidence also support this view: first, market size is related to new entry of Competitive Local Exchange Carriers (CLECs) (Beard, Ford & Koutsky, 2005; Alexander & Feinberg, 2004; Greenstein & Mazzeo, 2003; Zolnierek, Eisner & Burton, 2001). Beard et al. (2005) examined the entry pattern of CLECs in the US local exchange markets and found that a larger market is likely to cause an additional CLEC's entry. Greenstein and Mazzeo (2003) also examined the entry strategies of CLECs and found that market size is positively correlated with the entry of CLECs. Alexander and Feinberg (2004) discovered that an increase in population increases the likelihood of new entry in their study about the determinants of entry in local exchange markets. Zolnierek et al. (2001) also support the outcome that a new local exchange competitor is more likely to enter into highly populated urban areas. Since size is associated with the local demand potential, a higher local demand potential with high income and high population density tends to an increase of CLEC's entry (Clarke, Hassett, Ivanova & Kotlikoff, 2004; Rosston & Wimmer, 2001). Clarke et al. (2004) revealed that there was additional CLEC's entry in both high income and high density markets. Rosston and Wimmer (2001) also found that CLECs are more likely to enter into high income and densely populated markets. This positive relationship between market size and new entry can be applied to the broadband market as well, indicating that the new entrance in the residential broadband market must start from the urban areas with large populations and spread out gradually, unless providers are reluctant to enter rural and remote areas.

Second, entry costs are negatively associated with new entry into the U.S. local exchange markets, suggesting that a decrease in entry costs leads to a higher probability of entry (Ford, et al., 2005; Xiao and Orazem, 2005; Rosston & Wimmer, 2001). Ford, et al. (2005) identify four different types of entry costs, which would determine the number of new entrant: technological entry costs, strategic entry costs, regulatory entry costs and presence of spillover. Technological entry costs include any expenditure to build up networks, including sunk cost. Strategic entry costs can arise due to the incumbents' deterring strategies such as excessive advertising. In particular, in the convergent telecommunications market, Ford et. al. (2005) emphasizes spillover effects which are reductions in entry costs arising from the ability of a firm to use its existing

assets to provide service in a related market. Historically entrants owning their existing assets are likely to enter the other market. This indicates that without spillover effects, entry would not have occurred. Also, only those firms with assets can afford to enter (Ford, et al., 2005, p.34). This further indicates that higher costs will deter additional entries and new entrants de novo are likely to enter the market in smaller scale than the existing companies.

Xiao and Orazem (2005) recently examined market structure and competitive conduct in local markets for high speed Internet service from 1999 to 2003. They found unreasonable variation in firms' competitive conduct over time. Once the market has one to three firms, the next entrant has little effect on competitive conduct. Also, they found that entry costs for early entrants are smaller than for later entrants, implying the existence of early mover advantages in this market. Thus, they conclude that sunk costs are a main determinant of entry thresholds so that ignoring sunk costs leads to biased measures of entry thresholds and misleading inferences about firms' competitive conduct. These findings indicate that there will not be much difference in the existing companies' competitive conduct with the third competitor, and new entrants should decide their entrance based more upon strategic barriers established by the first mover's advantage such as a highly recognized brand name and sunk cost.

Third, regulation and competition policy will greatly influence a decision of new entry (Alexander & Feinberg, 2004; Brown & Zimmerman, 2004; Rosston & Wimmer, 2001; Abel & Clements, 2001). Alexander and Feinberg (2004) observed that the probability of the entry of CLECs is higher in the markets where the ILEC is regulated by the traditional regulatory method, such as rate-of-return regulation. Although the Telecommunications Act of 1996 induced entry, the competitive effect was limited by strategic non-price behavior of incumbents in local telecommunications markets. Thus, they argue that, to the extent that regulatory policies can prevent the exercise of the strategic entry-detering activity, regulators can play an important role in determining how much entry does occur. Brown and Zimmerman (2004) also examined the effect of the FCC's section 271 decision on new entry into the local exchange market and found that the decision had increased new entry into local exchange markets before and while the approval was granted. Rosston and Wimmer (2001) examined the effect of the federal subsidy policy on competition in local exchange markets and found that the presence of federal high-cost support increases the probability of new entry.

As indicated in the literature above, regulatory policies more favorable towards new entrants to eliminate entry barriers such as open access rules (e.g., unbundling and resale entrance) and subsidy assistance (e.g., universal service support) increased entrance into the local telecommunications market. Since CLECs tend to provide DSL services altogether with a local telephone service, a higher number of CLECs indicates a higher number of broadband competitors in the residential market. Thus, higher barriers to entry for CLECs imply higher barriers to entry to Internet access service providers that may enter the market by either resale or unbundling. However, it is suggested that the FCC's "systematic elimination of pro-competitive regulation" has led to the declining market share of CLECs in the wired broadband access service (Marcus, 2006, p.31). As a percentage of all ADSL lines, CLEC ADSL lines steadily declined to 4.3% in 2004 from 5.4% in 2003.

2.3.2. Incumbents' strategies for deterring new entry

Several studies have also examined the pre- and post-entry strategies of an incumbent in the US local exchange markets. Pre-entry deterrence of an incumbent in a market can be found in Nix and Gabel (1993), and Rosenberg and Clements (2000). For example, Rosenberg and Clements (2000) found that an ILEC deters entry by reducing or eliminating the potential competitor's profit opportunities by imposing high costs. Nix and Gabel (1993) also suggested that, historically, a telephone carrier (e.g., AT&T) did not adopt a price strategy to deter new entry when the company had an increasing threat of competition, but instead, leveraged patent litigation to deter new entry.

Other studies have examined the relationship between new entry and an incumbent's post-entry reaction in a market (Kaserman, Mayo, Blank & Kahai, 1999; Koski & Majumdar, 2002; Loomis & Swann, 2005; Woroch, 2000). Kaserman et al. (1999) examined the effect of the entry of facilities-based inter-exchange carriers (IXCs) on the pricing of Regional Bell Operating Companies (RBOCs)' local residential telephone services and found that entry was not significantly influence the local residential rates of RBOCs. Loomis and Swann (2005) examined the effect of the emergence of CLECs on ILECs in U.S. local exchange markets using a Cournot response function and found that the expansion of a CLEC has a greater competitive impact on ILECs, while the expansion of an ILEC has a relatively smaller impact on CLECs. Woroch (2000) examined the effect of new entry on the digital infrastructure investment in the U.S. local exchange markets and found that the entry of CLECs leads to subsequent investment of an ILEC, and the investment of the ILEC leads to additional entry of CLECs. Also, after entry occurred, ILECs were more likely to respond with aggressive advertising and withdrawal of diversification rather than an aggressive pricing (Koski & Majumdar, 2002).

As suggested in the previous literature, it seems evident that the incumbents in the local telecommunications network market have had great competitive pressure on their telecommunications services but they are more likely to respond to it by employing intense advertising or other leverage for the purpose of erecting barriers rather than to compete on price directly.

3. Analytical Framework: Evaluation of the presence of barriers to entry

The evaluation of barriers to entry in telecommunications has been used to either evaluate the market power of the incumbents or limit requested mergers in light of their impact on market competition. The Office of Fair Trading in the U.K. earlier published a report suggesting the best practices to assess barriers to entry in a market and proposing methods of measuring entry barriers (OFT,1994).

Adjusting the OFT's "seven step procedure for assessing entry conditions" to the telecommunications market, Kim and Lee (2005) suggested eight evaluation steps of barriers to entry and conducted a case study about South Korea's retail broadband access market. The eight evaluation steps are: (1) the establishment of market boundary and production substitutability; (2) market conditions and the record of entry and exit; (3) absolute cost advantages of the incumbents; (4) sunk cost, economies of scale and capital requirements; (5) product differentiation, advertising, switching cost, and network externalities; (6) vertical foreclosure and

exclusion; (7) predatory behavior; (8) entry impediments such as certification requirements and required time to build up brand name.⁶ Each step will be examined with essential questions as following:

Step 1. Market definition and entry by production substituters

First, it should be determined whether one or more firms in a market face competition from 1) existing rivals and 2) from potential new entrants. So-called “production substituters” are included in the definition of relevant market and the focus here is entirely on demand substitutability. The following questions need to be answered: Are there potential suppliers or production substituters that could switch easily and quickly to the supply of the relevant market? Are there neighboring industries or markets which use a similar production technology? Are there producers which use similar distribution channels and distribution networks that could start production or acquire the relevant market? Are there firms which produce the relevant product in other geographical markets? Has there been import substitution in the past in response to changes in domestic or external market conditions?⁷ More questions follow: Has there been product substitution in the past in response to a price increase in the relevant market? Is there idle capacity in the industry? Are there large buyers who could easily supply themselves? Are there vertically integrated firms who could easily increase their production to serve the open market? If one or more of these questions yields a positive answer, then this may be prima facie evidence of an absence of serious entry problems.

Step 2. Market conditions and historical entry

Factual information about the recent performance of firms in the relevant market is a useful guide in the assessment of entry conditions. What has been the recent history of entry and exit in the relevant market? What has been the recent trend of profitability of the industry? How effective has entry been in constraining the exercise of market power? Have market conditions changed recently? If recent market history exhibits substantial entry via investment in new capacity on a large scale, then there is a priori little reason to suspect that significant barriers to entry exist. However if successful entry has been exclusively large-scale, then the existence of scale economies may be suggested. If entry has been small-scale, short-lived or merely by acquisition, more investigation will be required. Empirically most entry is of this type, so it is not enough simply to observe or count recent entry episodes. Rather some measure of scale and significance of entry must be used. The profitability of firms and time required for a new entry, and changes of market competitiveness such as a change in the number of active firms should be questioned.

Step 3. Assessment of absolute (cost) advantages

Absolute cost advantages can be defined as costs which must be born by the entrant but which are not born by incumbents. They correspond to the cost asymmetries between firms

⁶ The following 8 steps are mostly derived from the Office of Fair Trading (1994)’s enumerated discussion about barriers to entry.

⁷ However, this question is not applicable in the telecommunications market because the ownership from outside of the domestic boundary would be strictly controlled by the government.

which would normally be captured under the Stiglerian definition of barriers to entry. Examples include exclusive or superior access by an incumbent firm to particular necessary inputs such as patents, copyright, exclusive contracts with input suppliers, ownership of a network, etc. Most legal and regulatory barriers to entry come under this heading. Cost asymmetries due to superior efficiency of incumbents, however, should not be included.

Step 4. Sunk cost, economies of scale and capital requirements

The interaction of sunk costs with economies of scale to create barriers occurs in the telecommunications market (Gabel, 2002; Sidak, 2006). If entry requires that some costs be sunk then what matters to entrants is the expected price post-entry. This will be determined by a number of factors, but perhaps the most important is the nature or intensity of expected post-entry competition in the market. Hence an important, if subtle and difficult, question which must be addressed in any serious analysis of barriers to entry is: What is the nature and what are the instruments of market competition? How has the market reacted to entry in the past? Price wars, accommodation, collusion, etc.? How has the market responded to exit in the past? Price increases, output reductions, reestablishment of stable or collusive pricing strategies etc.? How sunk are costs? Short-term, long-term? What is the proportion of sunk costs to total costs?

Step 5. Product differentiation, advertising, switching costs and network externalities

Product differentiation is common in any industry because it could be used strategically to have an advantage over competitors and to weaken price competition (Ford, et al., 2005). When products are homogeneous, the competition would be likely to arise on price. So, to avoid fierce price competition, firms tend to pursue product differentiation. In industries where products are differentiated, however, advertising, brand proliferation and goodwill have been identified as possible important sources of (strategic) barriers to entry in some circumstances. If sunk costs are required to advertise or establish a market presence, etc. then entry is in general more risky, and incumbents may be in a position to exploit first mover advantages. The rapid development of technologies has made it possible to produce a variety of services in the telecommunications industry and this makes product differentiation and advertising more critical strategic barriers to entry. This indicates that, despite the differences of access technologies, the broadband access service refers a homogeneous and price-sensitive high speed Internet.

Ford, et al. (2005) also suggests that product differentiation between intra-modal competitors would be less than between intermodal competitors by illustrating a study about competition between cable TV and DBS. The study reveals that the competitive effect of the intramodal competitors is three times greater than that of the intermodal competitors.⁸

Some critical questions can be addressed as follows: Are products highly differentiated? Associated with brand names? How important is R&D in the industry? Is product development important? How important is advertising? What is the ratio of advertising expenditure to sales

⁸ DBS providers reduced cable prices by about 5%, whereas the terrestrial video rival reduces price by about 16% (GAO, 2005). US Government Accountability Office (GAO) (2005). *Direct broadcast satellite subscribership has grown rapidly, but varies across different types of markets*. Report to the Subcommittee on Antitrust, Competition Policy and Consumer Rights. Committee on the Judiciary, U.S. Senate.GAO-05-257. (cited in Ford, et al., 2005, p.24)

revenue? Do consumers face switching costs, i.e. are they locked in to a specific supplier, or is it more costly for them to purchase from alternative suppliers for reasons unrelated to price and production costs? How large are switching costs? And what strategies are available to firms to create consumer loyalty, i.e. exclusive contracts, loyalty rebates and discounts, price-matching strategies, etc.?

Step 6. Vertical foreclosure and exclusion

A long list of practices can be identified as vertical restraints such as vertical integration and vertical mergers, exclusive dealing and contracting, exclusive territories and franchising, exclusive/long term contracts with customers, refusal to supply, and product tying and bundling. This list is not all-inclusive but is suggestive of the range of practices which have been considered to raise antitrust concerns by creating entry barriers. The difficulty posed for competition authorities by these analyses is to identify when these types of conduct and other vertical restraints, are likely to have serious anticompetitive effects. Gabel (2002) detects that without vertically integrated structure, new entrants based on structural separation are likely to fail because they would increase rather than reduce uncertainty.

In particular, the telecommunications industry has shown a strong trend of vertical integration by networks. To communicate in the telecommunication network, the sender and the receiver has to be connected through the physical networks with the premises. In most countries, a monopolist which owned both the last mile⁹ and interconnected networks had been providing the end-to-end service. Plausible questions are as follows: What is the nature of incumbent relations with input suppliers or distributors/retailers/buyers? Are there exclusionary contracts? Tying arrangement? Territorial exclusion? Long-term contracts? Loyalty rebates? Most-favored clauses? Are there scarce inputs needed for the production of the relevant product(s) which are controlled by incumbent firms? What is the market structure of essential input markets, and are incumbents able to exert market power in these markets, either individually or jointly? Must potential entrants be vertically integrated? Does the vertical restraint raise an entrant's costs significantly? Has the interconnection among network providers been mandated?

Step 7. Predatory behavior

Predatory behaviors such as predatory pricing can be a part of strategic barriers that incumbents wield to deter the entry of new entrants. In particular, predatory pricing refers to a strategy to set the price below the reasonable cost either to squeeze rival firms out of the market or to deter the entry of potential competitors. If it were successful, the incumbent would be able to dominate the market and enjoy monopolistic pricing. Distinguishing predatory from normal competitive behavior is a subtle task and need not be attempted if the preconditions for rational predatory behavior are not satisfied. In particular, for predation to be rational a firm must be able to exercise significant market power post-exit (or merger) in order to recoup the losses (in foregone profits) incurred by the predatory behavior. Thus the first step is an analysis of market structure with a view to determining when predatory behavior could be a rational strategy. Relevant questions would include: What is the market share of the (alleged) predatory firm?

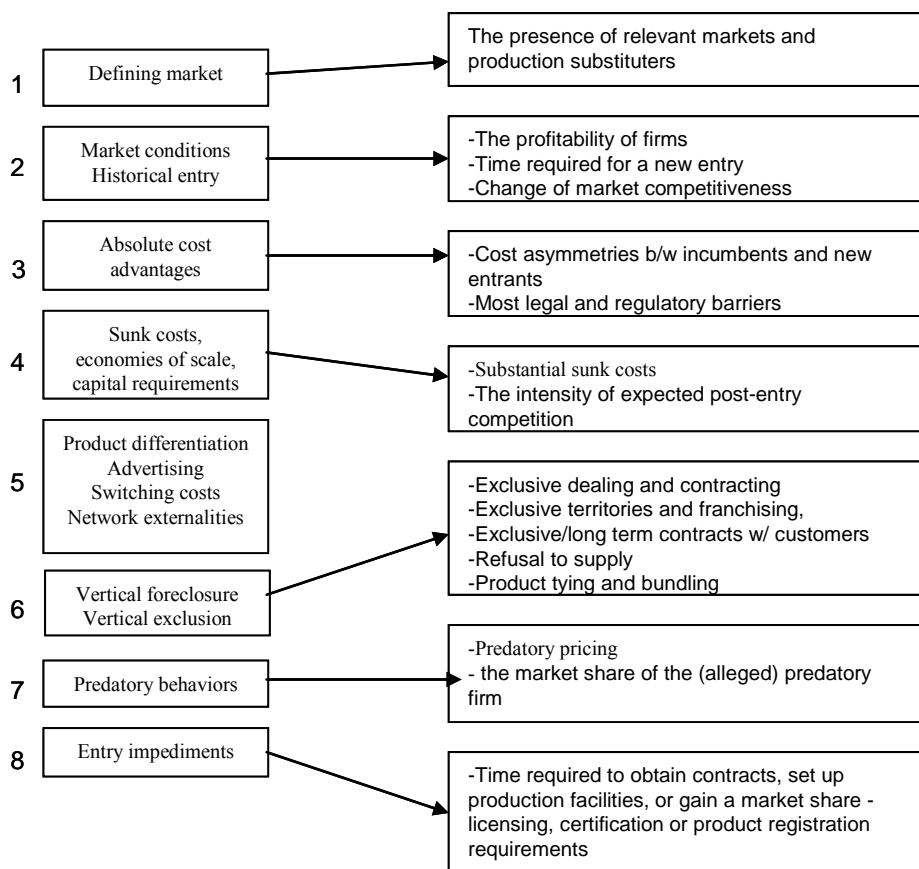
⁹ The wireline bottleneck facilities linking the public telecommunication networks with virtually every home and business premises nationwide.

What are the sizes of other firms in the industry? Are there any other important barriers to entry? Can the predator target price cuts where its rival is most vulnerable, and minimize its own foregone profits? If the preconditions for successful predation are not met, then the inquiry in most cases needs go no further.

Step 8. Assessment of entry impediments

Entry impediments are any factors which delay the process of entry into a market without increasing the (sunk) costs of entry, or creating an asymmetry between incumbents and entrants. They are not entry barriers that afford persistent incumbent supra-normal profits, but they may be important to antitrust decisions to allow a merger for example, because they influence the amount of time that incumbents may exercise market power before entry occurs. Good examples of entry impediments are licensing, certification or product registration requirements which involve little or no actual costs, but take significant amounts of time to satisfy. Other examples include the time required to obtain contracts (i.e. where the market's products are sold via long term contracts), set up production facilities, or gain a market share large enough to significantly influence the behavior of incumbents. However it should be noted that the distinction between entry barriers and entry impediments is not always sharp.

Figure 1. Evaluative steps to determine entry conditions



4. Analysis: The Broadband Market and Barriers to Entry

Step 1. Market definition and production substitutes

In the U.S., broadband is defined as a service or facility with an upstream (customer-to-provider) and downstream (provider-to-customer) transmission speed of more than 200 kilobits per second (kbps). The FCC has used the term “high-speed” to describe services and facilities with over 200 kbps capability in at least one direction.¹⁰ Even though the definition has often been criticized as not being able to incorporate real advanced features of current broadband technologies, the FCC has not responded to this voice yet (Turner, 2005). Thus, the broadband market will be defined as a high-speed Internet service market with a rather moderate speed. Under the definition, every kind of access service currently available must be included in the range of the broadband service even though the speed is often not enough for VOIP and video that require much faster bandwidth.¹¹ Although only a few technologies, i.e., cable modem and xDSL have dominated the U.S. residential broadband market until now, the FCC has encouraged broadband deployment across multiple platforms based on different technologies. In particular, WiMax and fiber optic access technologies are the most promising of all in the near future.

In South Korea, the relevant market for the residential broadband service refers a market for Internet access service of which the download speed is more than 1 Mbps (MIC, 2002). This includes DSL, cable modem, B-WLL,¹² Ethernet LAN, satellite Internet and so on. A geographic market for residential broadband in South Korea was defined as the whole nation because pricing and service quality of different platforms are very similar across districts. Although the majority of the area of both countries is covered by cable modem or ADSL, there exists a set of new entrants or prospective entrants such as wireless broadband providers and BPL providers in the residential broadband access market.

Step 2. Market conditions and historical entry

The U.S.

In the U.S., the residential broadband market has been dominated by cable and incumbent telephone companies. While new entrants, based upon wireless, satellite and BPL technologies, have been gradually increasing, aggressive marketing of telephone companies and the rather stable dominance of cable companies have left them behind in terms of market share. While the market share of coaxial cable access from 1999 to 2004 slightly increased from 51.3% to 56.4%, ADSL share increased from 13.4% to 36.5% during the same period of time. Instead, other wireline technologies including symmetric DSL and fiber, wireless and powerline have been rapidly decreasing (from 22.1% to 3.9% and from 11.3% to 1.8%, respectively). Incumbent local exchange carriers (ILECs) still represented about 96% of facilities-based ADSL high-speed lines

¹⁰ The FCC. (2002). *Inquiry concerning the deployment of advanced telecommunications capability to all Americans in a reasonable and timely fashion and possible steps to accelerate such deployment pursuant to Section 706 of the Telecommunications Act of 1996*. CC Docket No. 98-146 (February 6, 2002). Retrieved from http://www.fcc.gov/Bureaus/Common_Carrier/Reports/fcc99005.txt (Figliola, 2006).

¹¹ A telecom research company reports that 42.8 million people subscribed for either cable or DSL broadband at the end of 2005, up 9.6 million from a year before. Also, it recognizes the new explosion of consumer-generated content such as MySpace pages and YouTube videos, and the demand for more bandwidth (Fox, 2006, March 22).

¹² Broadband Wireless Local Loop.

in service as of Dec. 31, 2004. When all technologies are considered, ILECs still provide about 38% of high-speed connections to end users (FCC, July 2005).¹³

The incumbent telephone companies (ILECs) have started aggressive pricing and differentiated broadband service as one with different connection speeds. Cable companies have reduced prices in specific markets for existing video customers but mostly have kept their normal broadband pricing (Rosenbluth, 2006, August 24). While, in the first quarter of 2006, the average price for broadband service was \$39.45 a month from the five top cable operators, the top four telephone companies' pricing was \$35.38. Telecom DSL pricing has declined, on average, 7% from approximately \$38 in the first quarter of 2006 (A report from Kagan Research LLC, cited in Rosenbluth, 2006).

According to a recent report of the FCC, the number of high-speed Internet service providers significantly increased from 105 providers in Dec., 1999 to 552 providers in Dec., 2004 (table 4). If providers with less than 250 lines are included, the number of providers amounts to 1269 in June, 2005. ADSL providers have led the major growth by recording more than eleven times increase in numbers since 1999. Since the FCC data in June 2005 started to include small companies with less than 250 lines, this indicates that small providers are still dependent on DSL lines or cable lines rather than other access technologies. Interestingly, while the number of ADSL and cable modem providers has consistently increased, that of all other technologies has been rapidly decreasing since Dec. 2004. Furthermore, since this data did not separate residential and business services, it is hard to estimate the number of entrants in the residential broadband access service market with only the FCC data.

Table 4. Providers of high-speed lines by technology, the U.S. (Dec. 1999-June 2005)

	ADSL	Growth	Cable Modem	Growth	All other	Growth	Total	Growth Total
Dec 1999	28		43		65		105	
June 2000	47	68%	36	-16%	75	15%	116	10%
Dec 2000	68	45%	39	8%	87	16%	136	17%
June 2001	86	26%	47	21%	98	13%	160	18%
Dec 2001	117	36%	59	26%	122	24%	203	27%
June 2002	142	21%	68	15%	138	13%	237	17%
Dec 2002	178	25%	87	28%	169	22%	299	26%
June 2003	235	32%	98	13%	217	28%	378	26%
Dec 2003	274	17%	110	12%	246	13%	432	14%
June 2004	298	9%	129	17%	281	14%	485	12%
Dec 2004	352	18%	147	14%	312	11%	552	14%
June 2005	759	116%	227	54%	205	-34%	1269	130%
Growth Rates (Dec.1999-Dec.2004)		1157%		242%		380%		426%

¹³ More recent market reports estimate that as of March 2006, AT&T Inc. (through its SBC segment) had the greatest number of DSL subscribers among the telecom carriers, with 7.8 million total, which is up 30% from a year earlier. Verizon had about 6.1 million DSL and other higher-speed broadband customers, up 48% from a year earlier, and independent ILEC CenturyTel's broadband line count climbed 61% to nearly 313,000. However, despite telephone companies' recent progress, cable companies have taken the larger share of the high-speed Internet connection market. As of the first quarter of 2006, cable television firms (such as Comcast Corp. and Cox Communications Inc.) accounted for 56% of traditional broadband connections, while DSL comprised the remaining 44%. In 2006, telecom carriers such as Verizon and AT&T also were adding wireless broadband customers, but these are not part of this counting (Rosenbluth, 2006, August 24).

Source) FCC (2006) * All other includes Symmetrical DSL (SDSL), traditional wireline, fiber, satellite, fixed and mobile wireless, and power line. **For data through Dec. 2004, only those providers with at least 250 lines per state were required to file. Thus, it seems reasonable to look at the growth rate from Dec. 1999 to Dec. 2004.

Here we examine recent movements of alternative technologies such as wireless, satellite and BPL in the broadband access market.

Wireless residential broadband

According to an industrial report (Gibbons & Ruth, 2006), there are low barriers to entry in the Wi-Fi access market. Relative ease of obtaining equipment, an unlicensed and free Wi-Fi spectrum, and relative availability of technical know-how have combined to act positively towards municipalities' deployment plans. Also, a few of smaller ISPs and big ISPs¹⁴ have rapidly started or experimented with wireless broadband services based on WiMax technology, which is more advanced than Wi-Fi (FCC, 2005, September 30).¹⁵ For example, Clearwire, TowerStream and Nextel have started trial wireless broadband services since 2004. Both wireline and wireless carriers are trying to incorporate WiMax in their networks because this enables them to get out of paying huge access costs, or to lower operating costs. The problem is that this development has been driven by large carriers for business customers while smaller WISPs tend to serve residential and small business users (Selwyn, et al., 2005). Although broadband wireless still has a very small market penetration, the wireless broadband connection has been growing faster than other broadband access options.¹⁶

Meanwhile, many municipalities have entered or plan to enter the residential broadband access market adopting Wi-Fi technology or all-fiber networks (Balhoff & Rowe, 2005; APPANET, 2004). Historically, some municipalities have already entered communications markets by providing high-speed Internet and video services to their territories through public utilities or contracts with private companies (APPANET, 2004). More recently, several big cities and municipalities announced plans to deploy mesh networks using Wi-Fi technology¹⁷ (Harrell, 2006, Jan. 27; Woolley, 2005, July 4). Mesh networks use lots of small, cheap transmitters that are easily mounted on a streetlight or telephone pole. Each transmitter can only send signals short distances, often just a few hundred feet, but a mesh of them can cooperate to relay a signal far across town, handing it from point to point like a baton in a relay race. Minneapolis, Philadelphia and Tempe have committed to setting up wireless networks and Boston and San Francisco are also exploring the idea. Madison, Wisconsin just signed a deal with AOL to build and run a mesh network (Woolley, 2005, July 4). The recent municipalities' efforts to deploy their own networks have been controversial but seem inevitable in that municipalities' initiatives attract incumbents rather than pits itself against them (Gibbons & Ruth, 2006). A new study released by CFA, CU, and other public-interest groups shows that community Internet providers,

¹⁴ Independent Internet service providers (ISPs) could subscribe to local telephone service lines through which their customers transmit computer-generated information to them. The ISP transforms data transmitted in telephone signal format into data packets and routes the traffic over its own packet-switched network to the intended destination, often via transmission over backbone long-distance networks to another ISP network. (Zelinski, 2004).

¹⁵ WiMax is the complementary technology to Wi-Fi. It has a service range of up to 50 km and provides data rates of up to 280 Mbps per base station. WiMax can be used for Internet calling, video, and chatting (Leon & Wang, 2005, Nov. 3).

¹⁶ While satellite and terrestrial wireless technologies only occupied less than 0.15% of total lines of high speed Internet, the growth rate of satellite and wireless in 2004 was 30% compared to 9% of power line (FCC, 2005).

¹⁷ Wireless Fidelity (Wi-Fi) is an extension of wireless local area networks (WLANs) and makes use of low-power transmitters in unlicensed frequency bands. Although the coverage area for WLANs is limited to small areas (about 100 m), rapidly improving cost-performance makes it a viable option for public services in locations such as hotspots (i.e., restaurants, coffee shops, hotels, airports, convention centers, etc.), rural communities, and dense urban areas.

or even the threat of municipal entry, could provide the competition necessary to keep rates low and quality of service high.¹⁸

Moreover, small ISPs have recently been threatened by the challenges ahead, especially as the number of dial-up subscribers has been dropping, following financial pressures, and as the regulatory movements against them have been shored up (van Gorp, Maitland, & Hanekop, 2006). Smaller broadband providers usually do not prefer being a facilities-based provider because of the necessity of a huge amount of capital in facility investment. The FCC's recent abolition of its line sharing rule may make it harder for smaller ISPs to compete in broadband Internet service. Thus, unless WISPs can find ways to substantially differentiate their services, there is no way for them to grow as a national competitor. Furthermore, the potential of advanced wireless technologies has been adopted by the incumbent telephone companies as a strategic tool for boosting their voice services. Even though municipalities have tried to add in wireless broadband into their communities, most of them still rely on the incumbent networks and private ISPs. When smaller WISPs do not have their own facilities, a non-line sharing rule will make them depend on their competitors' will to allow them to access to the last mile networks and facilities. Or they may eagerly seek for a chance to circumvent the bottleneck.

In South Korea, wireless broadband usually refers to the Internet access on cellular phones rather than the residential fixed wireless service. Residential wireless broadband services, using either B-WLL or wireless LAN technologies, have gained a very small portion of market share. Usually, incumbents provide wireless broadband Internet access to medium and low density housing complexes using B-WLL technology and in high traffic areas (such as hotels and commercial centers) using wireless local area network (WLAN) technology. In the residential broadband market, however, the wireless technologies have been generally complementary to the existing HFC or xDSL broadband services. An actual vision for the future wireless Internet service is WiBro, a kind of mobile WiMax service. WiBro (wireless broadband service) has drawn great attention because it can provide a certain level of space and portability to the high-speed Internet and wireless LAN. WiBro enables the user to access the Internet using portable wireless devices, and to use various forms of information and contents at a high speed. WiBro is expected to have a significant effect on society and culture as long as it overcomes the shortcomings of wireless LAN and mobile communication, and provides both the high speed data service of the wireless LAN and the portability of the mobile communication service. In Jan. 2005, the MIC of South Korea has selected three service providers: KT, SK Telecom and Hanaro Telecom (NCA, 2005).

Satellite

Broadband satellite is a capital-intensive business. As its subscriber base grows, additional satellites should be launched. Robust margins are required to repay that capital investment. The business of satellite broadband is similar to EchoStar's DISH business. With 10 million customers, the company's profitability is based on how aggressively they are in the

¹⁸ Feld, H., Rose, G., Cooper, M., & Scott, B. (2005). *Connecting the public: the truth about municipal broadband*. Retrieved Feb. 23, 2006, from http://www.freepress.net/docs/mb_white_paper.pdf#search=%22Connecting%20the%20Public%3A%20The%20Truth%20About%20Municipal%20Broadband%22

For example, community Internet providers are charging lower prices than Bell DSL service providers are charging: \$16 in Chaksa, Minnesota, \$20 in Rio Rancho, New Mexico, Moorhead, Minnesota and Lompoc, California, and an estimated \$15 in Philadelphia (Cited in Cooper, et al., 2005).

subscriber acquisition game. Satellite broadband will be similar to satellite TV but more profitable than that because broadband service does not require costs for contents. (Satellite News, 2004, Sep. 13). Recently, WildBlue, in a strategic relationship with Liberty Media, entered the high-speed Internet access market via satellite to homes and small businesses in June, 2005 focusing on rural or remote communities not currently served, or underserved by other high speed providers. The residential broadband service using satellite has been limited in its speed, up to 1 Mbps, and its uplink transmission, which should be made over telephone lines or mobile telephone networks. Thus, this service seems restricted to remote areas which find it difficult to receive fixed-line broadband Internet services like xDSL and cable modems.

BPL

A recent Congressional report (Figliola, 2006) enunciates the advantages and disadvantages of BPL. First, BPL is less expensive to deploy than the cable and telephone companies' broadband offerings. Second, it does not require upgrades to the actual electric grid, and third, it is not limited by certain technical constraints of its competitors. Also, thanks to the ubiquity of the electrical grid, BPL has been expected to be able to fill the gap in the broadband access market, in particular, rural areas in which there is relative lack of service (David, et al., 2005). In fact, companies in the U.S. and other countries have pilot tested BPL and many are now deploying it commercially (Figliola, 2006).

However, critics have expressed ongoing concern that BPL could interfere with licensed radio spectrum such as amateur radio, government, and emergency response frequencies. In addition to the frequency interference issue, legal and regulatory uncertainty has delayed the entrance of BPL providers in the residential market. Although the FCC is not licensing BPL services, BPL services are still regulated in the same sense that any business is regulated and many other laws regarding contracting or doing business electronically. Also, state governments have regulated on various aspects of electric utilities such as rights of way and access to multi-tenant facilities (David, et al., 2005).

Zelinski (2004) points out that BPL has had to have some problems resolved to deploy smoothly such as 1) harmful radio interference; 2) access issue; and 3) cross-subsidies issue. Interestingly, Zelinski (2004) argues that BPL providers should be allowed to build up new platforms with proprietary protocols and designs different from those employed by cable and telephone companies. To encourage economic entry by BPL providers, "regulators should support flexible, creative designs (of BPL), and should not mandate standardization" (Zelinski, 2004) (e.g., TCP-IP protocol use). Also, government should allow vertical integration by broadband transport operators into applications and content to make the platform of a profit-maximizing broadband transport operator more valuable.

Since electric utilities provide a regulated monopoly transmission and distribution service, their provision of a competitive BPL service would present a risk of cross-subsidy by the former to the latter. Whether the government allows electric utilities provide the broadband service directly or independent BPL providers to get access to the distribution system are not clear yet. In particular, since BPL systems use facilities occupying public rights-of-way, the regulation by local governments is likely. With technical problems, e.g., radio frequency interference, regulatory and policy uncertainty are one of the biggest barriers to BPL providers.

South Korea

In South Korea, Internet access (and its management service) market had shown explosive growth rates over the early years of broadband access but since 2000, it has been rather stagnant. Fierce competition among five residential broadband providers has led to price decrease and free installation service. As a result, despite an increase in subscribers that amount to 42.84 million, the sales revenue slipped by 8.5% to 822.5 billion won over the previous year in 2003. Instead, the sales revenue for ISP service has slightly grown 9.9% to 379.9 billion won in 2003 compared to the previous year (MIC, 2003).

Table 5. Broadband Internet market shares in South Korea (%)

Providers	Access Technologies	Entry	1999	2000	2001	2002	2003	2004	Aug-2005
Korea Telecom (KT)	xDSL/Apt. LAN/Satellite	June '99	5.1	43.9	49.7	47.3	50.0	51.0	51.8
Hanaro Telecom	xDSL/Cable Modem(HFC)*/Apt. LAN	April '99	33.3	28.0	26.4	27.6	24.4	23.1	23.1
Thrunet	HFC/Apt. LAN	July '98	56.2	19.3	16.8	12.5	11.6	10.8	7.8
Onse Telecom	HFC/Apt. LAN	Aug. '00	-	1.8	2.7	4.3	3.8	3.3	3.1
Dreamline	xDSL/HFC/Apt. LAN	Sept. '99	5.3	3.9	2.3	1.6	1.3	1.1	1.1
Dacom	HFC/Apt. LAN	1999	-	2.3	1.6	1.4	1.8	1.7	2.1
Others	xDSL/HFC/Apt. LAN		-	-	-	5.2	7.1	9.0	10.9

Source) NIC (2005). * HFC refers to cable modem service based on the optical fiber network to a node.

The total number of ISPs increased from 83 in 2001 to 101 in 2002 but it has been decreasing since. Currently 78 commercial Internet networks exist. ISPs, which own and operate their own Internet backbone networks, include KT (KORNet), Dacom (BORANet), Onse (Shinbiro), Hanaro Telecom (HANANet), Thrunet, Enterprise Networks (GNGIDC), Dreamline (DreamX), Samsung Networks and LG Powercom (NCA, 2005, 2006).

As for the high-speed Internet market share, as shown in table 5, KT has dominated the market with 51.8% and Hanaro Telecom follows with a 23% market share. Other indicates smaller ISPs such as regional cable system operators (hereinafter, cable SOs), which take over the market quickly since 2001 with a 10% market share. Table 5 also reveals that ISPs in South Korea have provided the service based upon multiple platforms utilizing wireless (e.g., apartment LAN using B-WLL), cable and telephone networks at the same time. Only KT has used satellite for providing rural and remote user access to the high-speed Internet.

On the other hand, the broadband market structure has kept changing since entry. For instance, SK telecom entered the residential broadband market in 2000 but exited in 2001 because it failed to obtain enough subscribers to survive in the market. While in the market, SK telecom had a very limited market share, about 0.6% (total 44,346). In Dec. 2001, Hanaro merged with Dreamline as a result of restructuring among the major ISPs. Also, Hanaro acquired Thrunet in Dec. 2005, which was in legal protection. Thus, the market share of Hanaro will be about 32% including Dreamline and Thrunet. Currently, two dominant providers exist in the residential broadband market, i.e., KT and Hanaro Telecom.

Table 6. High-speed Internet service subscribers (South Korea) 2006

Unit: persons

Provider	Xdsl	HFC	Apartment LAN	Satellite	Total
KT	5,509,576	-	757,090	2,616	6,269,282 (51%)
Hanaro Telecom	937,031	2,147,083	500,030	-	3,584,144 (29%)
Onse Telecom	-	305,534	37,734	-	343,268 (3%)
LG Powercom*	-	218,462	111,646	-	330,108 (3%)
Dacom	-	86,031	121,227	-	207,258 (2%)
Dreamline	40,417	49,248	11,032	-	100,697 (1%)
Value Added Service Providers **	11,454	1,178,128	19,018	-	1,208,600 (10%)
Resellers	36,650	42,105	168,913	-	247,668 (2%)
Total	6,535,128	4,026,591	1,726,690	2,616	12,291,025 (100%)

Source) MIC, Jan. 2006, cited in NIDA (2006) * New entrance in Sept. 2005 ** Cable SOs

However, the new entries of LG Powercom in September 2005 and cable SOs will bring more competition into the picture. LG Powercom, which was established in 2000 with optical fiber networks and cable TV Networks from Korean Electric Power Corp. (KEPCO) entered the broadband market. The Hybrid Fiber Coaxial (HFC) networks of LG Powercom can provide up to 155 Mbps Internet access service to residential users (NCA, 2005). Also, the entrance of regional cable SOs in small regions has been increasing. In June 2004, there were about 118 regional cable SOs and a significant number of those have provided residential broadband service to mostly apartment complexes.

Similarly as in the U.S. case, the SOs have bundled cable television and high speed Internet at cheaper price than what it would be without the bundle. SOs have entered the market in a certain area (surrounding SO franchise area), rather than on a national scale. Currently, the most prospective entrants are still regional SOs on a small scale and, main telecommunications companies do not seem to enter sooner or later on a national scale. Since 2002, certain providers have achieved marginal profits but in general, none of those providers has achieved supra-normal profits (Kim & Lee, 2005).

In South Korea, the residential broadband market has shown a high percentage of growth rates for last several years but it has been decreasing recently. Since technological advances and service evolution have been much faster than other wireline telecommunications services, substantial competitive pressure exists on broadband access service providers. Even before any return on investment can be realized in the market, broadband service providers have to invest in other technologies. This might result in weaker competitiveness of providers with relatively weak financial capability. The weak competitiveness may be the reason behind the market restructuring.

As previously indicated, while there is vibrant competition between DSL and cable modems in South Korea, alternative broadband platforms, such as wireless and BPL, have not yet appeared as competitors in the market. Rather, they have been complementary convergence access technologies to the incumbents rather than as competitive technologies (Koh, Lee, & Kim, 2005). In fact, the advanced broadband infrastructure has referred to HFC or FTTH rather than ADSL, wireless and satellite. Furthermore, thanks to the speedier service of VDSL (Very high

bit rate DSL), ADSL subscribers have been migrating to the VDSL service.¹⁹ However, it is obvious that, in each residential market segment, more than five providers have been competing for subscribers including a new entrant, LG Powercom.

Step 3. Assessment of absolute (cost) advantages

There is no doubt that the ownership of essential facilities such as the last mile networks will bring absolute cost advantages to incumbents. Incumbents have exclusive or superior access to inputs such as patents, spectrum, essential facilities and networks. Whether there are essential facilities in a market has been a threshold to tell whether there is a monopolist in control of a facility essential to other competitors. New entrants must get reasonable access to that facility if it is feasible to do so. Without the access, new entrants have to face a substantial cost disadvantage in contrast to incumbents with substantial cost advantages. In case incumbents have no incentive to provide new entrants (or competitors) access to essential facilities (e.g., the last mile networks), the government may set rules concerning access to influence the height of the barrier (Blees, et al., 2003).

Historically, access to essential facilities by new entrants has been limited in the U.S. Several reports recently published by consumer advocates groups and researchers (Selwyn, et al., 2005; Turner, 2005, 2006; Marcus, 2006) point out some restraints and lack of competition in the last mile. First, cable overbuilds have occurred in a limited number of locations, but only a single cable system is available at 96.3% of all US households. Total number of residential broadband providers appears to ensure enough choice to a consumer. For example, there are SBC (AT&T), Verizon, Bell South and other telecom companies and Comcast, Time Warner, Cox, and Charter and other cable companies. However, as indicated in a report (Selwyn, et al., 2005), from the standpoint of an individual user, the total number of players available nationwide is not relevant. What is relevant is the specific choice available to a particular user in the user's own specific geographic market. The vast majority of households have only one cable company and one phone company offering high speed Internet service to their location. Turner, et al. (2005; 2006) shows that contradicting the rosy picture painted by the Federal Communications Commission and Congress, the U.S. broadband policy has failed by leaving Americans with higher prices, slower speeds and no meaningful competition for high-speed Internet service.

In light of ensuring access to essential facilities, South Korea has been very determined and aggressive. First, telecommunications operators in South Korea are classified into three groups: facilities-based service providers such as wire-line operators; specialized service providers such as Internet telephony; and value-added service providers such as those offering broadband Internet connection. Based on this classification, the telecom firms are governed by different regulatory systems with various entry conditions and limitations (Lee & Chan-Olmsted, 2004). For example, facilities-based telecommunications service providers are required to provide interconnection from the local exchange and long distance exchange. Specifically, only KT is subject to mandatory interconnection from the local exchange and long distance exchange, but all other facilities-based service providers should, when requested, provide an interconnection agreement. In contrast, value-added service providers, including those offering

¹⁹ VDSL (Very high bit rate DSL), which covers relatively short transmission distance (0.3Km~1.5Km) compared to ADSL but can offer speed up to 26 Mbps symmetrically compared to ADSL, which is limited to upload speed 8Mbps and download 640 kbps. Thanks to much speedier service, VDSL is gaining great popularity in South Korea (NCA, 2005).

broadband Internet access, have no entry regulation or unbundling requirement. Now that South Korea has opened the broadband Internet access market fully to competition, it also means minimal regulation for broadband Internet connection providers (Lee & Chan-Olmsted, 2004).

The government also abolished major regulations for Internet services and lowered market entry barriers. Any company can enter the broadband market with a variety of services, although critics maintain that there were already too many service providers for a market of Korea's size (KISDI, 2005). Consequently, the Korean government's policy makers are more inclined to push for competition through mandatory price cuts and lowered service costs that will stimulate the adoption and usage of communication services. The ensuing intensification of competition has enabled significant price reductions, while the entry of new players has provided customers with a wide range of choices (Yan and Thong, 2003, cited in Lau, Kim and Atkin, 2005).²⁰

According to Kim and Lee (2005), there exist no essential facilities in the broadband market in South Korea. Although the network in the last mile is an essential facility for DSL providers, there are many different alternative technologies to new entrants such as cable, wireless, satellite and power line. In addition, considering Local loop unbundling (LLU), facilities provision rules, LG Powercom's cable TV network for rent, there is no need to concern about essential facilities.

In addition, the revision of the Broadband Cable Television Law in January 1999 enabled cable SOs to compete in the residential local broadband market against incumbents, adding more competitive pressure to the access market. The revised law permitted one cable operator to own up to a maximum of 7 companies, allowed vertical integration and access to telephone company facilities for telecommunications. It opened a path for cable operators to provide cable Internet and cable telephony services by resale or their own networks (Lee & Schejter, 2005). Also, the government adopted two cable companies in a franchised area and allowed them to compete in cable television and other communications services.

The competition between two broadband cable television services in one area led to the absorption of the majority of narrowband cable subscribers by the broadband operators, endeavoring to sell economic tiers. Since second licenses were given in 2002, the penetration of broadband cable television has maintained a remarkable growth rate, reaching 57.0 percent of households in June 2003 and rose to 69.0 percent in June 2004, despite competition from satellite broadcasting. While the Korean Electronic and Telecommunication Basic Law²¹ requires cable SOs to get a license from the Ministry of Information and Communications (MIC) to provide cable telephony services, there is not any regulation for a cable system operator to provide broadband services through telephone company networks.

An amendment to the Telecommunications Business Act in 2002²² defines Internet access service as a basic telecom service, which requires either license or registration to provide the residential high-speed Internet service. Although new entrants should build up a certain scale of networks and obtain the license, this process of licensing is not necessarily an entry barrier, but makes the time of entrance rather delayed. A license does not invoke any additional sunk cost to a potential entrant but increases the necessary time for entrance. Instead, value-added

²⁰ Yan, X., Thong, J., 2003. Tariff-quality equilibrium and its implications for telecommunication regulation. *Telecommunications Policy*, 27, 301–315.

²¹ Cheonki Tongsin Kibonbop

²² Sec. 3, revised on July 20th, 2004.

service providers do not have sunk cost because they have no networks and are required only to register to get a license.

On the other hand, while KT has shown in a bid of VDSL modem provider, KT has much superior negotiation power in supplies and appliances markets than other providers. This power makes it possible for KT to enjoy the absolute cost advantage. In a bid for supplying 50 Mbps VDSL equipment, equipment manufacturers argued against price discounts KT asked because of the price increase of raw materials. Thus, KT, not equipment manufacturers, directly contacted the raw material providers to get lower price (Digital Times, 2003, September 22). It is rare that the buyer of equipment has a price negotiation with raw material providers. Thus, this case shows that KT has superior market power as an equipment buyer.

Step 4. Sunk cost, economies of scale and capital requirements

The necessary facilities required to provide broadband service are routing facilities for inter-exchange, transmission and last mile networks. If we define sunk costs as in the U.S. Merger Guidelines, they are “the acquisition costs of tangible or intangible assets that cannot be recovered through redeployment of these assets outside the relevant markets”, and determine the Internet service market as the relevant market, the transmission and last mile facilities are able to be recycled in other services markets. Therefore, these are not sunk costs.

However, routing facilities are sunk costs because they could not be recycled for other purposes except for the Internet access service itself. If the relevant market were limited to the high-speed Internet market, routing facilities and equipment could be recycled in the narrowband Internet market. In this case, routing facilities and equipment are not sunk costs. However, considering that the narrowband Internet access market in South Korea has been rapidly fading and there has been no new investment in the narrowband market, the relevant market should be defined as the Internet service market (Kim & Lee, 2005). Thus, routing facilities must be sunk costs in this case. In contrast, in the U.S., the narrowband service has been still viable in the Internet access market. Thus, the routing facilities may be recycled in this market so that they are not sunk.

Economies of scale and economies of scope

Both in the U.S. and in South Korea, dominant telecommunications providers continue to control the last mile networks, indicating that there exist both economies of scale and economies of scope because the presence of fixed costs enables average cost decreasing with an increasing number of subscribers (Miller, 1995; Brock, 1981). At the same time, network operators could use the network for other various services. Unlike local telephone service, national coverage is not a necessary requirement for Internet access services. However, the limitation of service availability is still a disadvantage in competition. For new entrants, the extent of the network coverage by incumbents could become a barrier to expanding new entrants' businesses because of incumbents' pre-occupation over subscribers and first-mover advantages (Xiao & Orazem, 2005).

Although absolute cost advantages of the incumbents exist resulting from economies of scale and scope, their importance has been declining because of dropping costs for service provision and development of niche markets thanks to technological innovation. Kim and Lee (2005) estimated the minimum viable scale of entry (MVS) of residential broadband market by

using Stigler's survival test and concluded that at about 25-30% of market size would be the MVS in the Korean market. To achieve the MVS, new entrance would require a tremendous amount of capital. In particular, assuming that a new entrant cannot reap profits for a while, capital requirements would be greater.

However, as for firms with economies of scope, such as LG Powercom and SOs which can provide a cable television service together, additional capital for entering the residential broadband market may be not so much required. Also, there are potential new entrants originating from non-telecom businesses that can ensure financial assets when entering the market. For example, Korea Electric Power Co. (KEPCO) owns power line communications networks (PLC) through which it can provide broadband access service.

Step 5. Product differentiation, advertising, switching costs and network externalities

It is well known that price and speed are more critical elements than differences of access technologies when normal users select a provider. The US broadband providers, in particular ILECs, have differentiated the high-speed Internet depending on speed as intending to expand available customer base. AT&T has offered *standard* and *preferred plans*, which provide 1.5 Mbps (\$29.95) and 3 Mbps (\$39.95) respectively with a full year service (AT&T homepage). In July 2006, AT&T started to offer a new 6 Mbps service for \$27.99 a month to customers signing up for a full year of service. The company also has offered three months of free broadband service and satellite service (through its partnership with EchoStar's Dish Network) to cable broadband subscribers if they switch over from a rival cable provider since July 2005. Verizon is also offering DSL service (at its introductory speed of 768 kilobits per second) free for the first month of service and for \$14.95 a month for the remainder of the year. Its 3 Mbps service — nearly four times faster — was priced at \$29.99 a month with a full year service. However, the seemingly generous offerings have been criticized as baits to allure dial-up users. And a real price war has not occurred in the broadband market (Turner, 2006).

In South Korea, since most service providers offer services at similar price, speed and added services, product differentiation among providers rarely exists. According to some surveys conducted by KISDI in 2003 and in 2004, there was no difference among the top three companies, i.e., KT, Hanaro and Thrunet in terms of individual users' perceptions of the service satisfaction level (KISDI survey, 2003, 2004, cited in Kim & Lee, 2005).

Brand recognition

In terms of brand recognition, KT among the dominant providers has shown the highest recognition rate in a survey in 2004 by recording 61%. This is a big difference compared to the second provider, Hanaro, which recorded a 26% recognition rate. Additionally, a logit regression analysis on the reason for selecting a service provider indicated that brand name recognition has influenced customers' selection decision. For example, KT showed a positive and significant relationship between the firm's brand image/trust and the selection decision whereas Hanaro and Thrunet showed negative but significant relationships (KISDI, 2003, cited in Kim & Lee, 2005). Also, a favor level test showed the order of KT, Hanaro, Thrunet, Dacom, Onse and regional cable TV system operators (SOs) in terms of users' favor level (KISDI 2004 survey, cited in Kim and Lee, 2005). Although there is no a comparable survey in the U.S., we

can easily estimate that dominant telephone and cable companies' brand recognition and brand power must be huge in the U.S. as well.

Switching costs

In the case of switching a provider, the remnant contract time, subscription fee, and replacement cost for equipment have been barriers to switching a provider on the customer side. Thus, service providers have offered subscription fee waiver, free use for a limited time, and so on to win the needed number of subscribers in South Korea. Also, given that modems have been standardized, switching costs of broadband service access have been minimal. Similarly, in the U.S., switching costs between DSL and cable modem has been ignorable. However, satellite has required a substantial amount of installation fee, on average, a few of hundreds.

Network externalities

Although Internet networks are open and interoperated networks, either when the transmission volume is not enough at the interconnection point or when the interconnection speed is not enough in the last mile, to subscribe for networks with more subscribers would be more advantageous in using advanced applications such as file sharing (P2P) and Web storage services. Further, content providers would find more advantage using networks with a greater numbers of subscribers. Therefore, both direct and indirect network externalities will exist.

Step 6. Vertical foreclosure and exclusion

Since vertically integrated providers may preclude new entrants from entering the market by refusing to provide last mile networks or excluding a specific new entrant, the South Korean government has legislated LLU (Local Loop Unbundling) and facilities-sharing rules. New entrants can enter the market by leasing the networks of LG Powercom, originated from KEPCO's optical fiber networks, on which SOs have already based their platforms. Thus, given the relevant rules and legislation to block vertical foreclosure, to prevent new entrants from entering the market through vertical integration would be difficult in South Korea.

Although vertical integration has not been a big concern in the U.S., current regulatory decisions of the FCC and the dominant status of incumbents may make vertical foreclosure and exclusion more plausible. As a vertically integrated entity, a dominant ILEC may have an incentive to maximize profits by using their leverage in the form of a price squeeze. Furthermore, the opportunity to run a classic price squeeze will be readily available in the form of excessive access charges.

Several economists also suggest that foreclosure effects are more likely to be present in situations when one of the markets (i.e., upstream or downstream) is highly concentrated (Bolton & Whinston, 1991; Bork, 1978).²³ With telecom networks and cable networks on the customer side, the last mile, has been highly concentrated, vertical foreclosure effects such as refusal to supply and exclusive dealing and tying arrangement are very likely. As Zelinski (2004) points out, cable companies have segmented the market by offering higher speeds than telephone companies for higher prices than telephone companies charge for DSL services. Cable companies have bundled proprietary content and applications with their cable modem and

²³ Bolton, P., & Whinston, M. (1991). The foreclosure effects of vertical mergers. *Journal of Institutional and Theoretical Economics*, 147, 207-226; Bork, R. (1978). *The antitrust paradox*. New York: Basic Books, cited in OFT (1994).

traditional television service offerings.

Indeed, product tying and bundling by incumbent providers have been criticized (Selwyn, et al., 2005; Cooper, et al., 2005). Critics say that incumbent ILECs will not sell a consumer DSL on a stand-alone basis. Users will be forced to buy their voice service in order to get a DSL service. This practice is also common in cable, which sells broadband for \$40-50 on average. Including its television service, it costs total \$80-100 per month (Cooper, et al., 2005).

Also, the telephone companies have had success in bundling a variety of communications services under one bill. An industry report by Standard & Poor's reveals that aided by the inclusion of broadband connectivity (through its DSL offering) and satellite TV service (through its relationship with EchoStar Communications Corp.), AT&T's revenues per retail consumer line rose 5.7% in the 12 months ended March 2006. AT&T had DSL penetration of approximately 29% of its consumer primary access lines, up from 21% in June 2005.²⁴ In March 2004, SBC and EchoStar began a co-branded, multi-channel television service that became part of SBC's local and long-distance bundled services. As of June 2006, the newly formed AT&T Inc. had 533,000 video subscribers and had extended its relationship with a more traditional, sales-agency approach that provided motivation for subscriber growth. In July 2006, AT&T was offering customers a quad-pack of its services (wireless through Cingular, wireline, broadband, and satellite TV) for \$125 a month (Rosenbluth, 2006, August 24).

The partnership between AT&T and EchoStar expanded in July 2006, as AT&T launched a television service called Homezone. The service will allow AT&T broadband subscribers to download hundreds of movies for a fee from the Movielink Web site and then view them on a TV set. The Internet service will be connected to a television set-top box by wired or a wireless connection and to an EchoStar satellite dish.

Verizon also made an agreement with EchoStar for the marketing and sale of its Dish Network subscriptions. As of March 2006, Verizon had 485,000 satellite TV customers through its triple-play bundle of wireline voice, broadband, and video. By mid-2006, Verizon was offering high-speed broadband and video service using its newly constructed fiber-to-the-premises (FTTP) network to customers in multiple markets, and the company had begun its initial launch of its fiber-based service.

Satellite partnerships are not just for the telecom carriers operating in metropolitan markets. In July 2005, rurally based TDS Telecommunications Co. announced an agreement with EchoStar to offer satellite service to its telephone customers under one bill (Rosenbluth, 2006, August 24). Utilizing the existing products will not only bring absolute cost advantages to incumbents, vertically integrated providers may have incentives to block new entrants in the broadband market by leveraging their market power.

Step 7. Predatory behavior

Koski and Majumdar (2002) examined whether new entry into the U.S. local exchange markets affects the behavior of Incumbent Local Exchange Carriers (ILECs) in terms of pricing, advertising and the extent of diversification. The authors found that the reaction strategy of

²⁴ These figures exclude secondary phone lines that are often used for dial-up Internet connections, as well as lines for enterprise customers (Rosenbluth, 2006, August 24).

ILECs is not related to an aggressive pricing but related to advertising, and ILECs cut back the extent of diversification when they face with the entry of a new competitor. However, as previously shown in the broadband market, ILECs have provided DSL services at a dial-up price. Although cable companies have not straightforwardly responded with price to the competitive pressure, new entrants may feel inappropriate to enter the residential market because of lack of profitability.

When a firm wants to conduct predatory pricing in the market, it should have a certain degree of market power and financial ability. This is called the theory of the “long purse”. After a competitive firm exits, the dominant firm should be able to increase its price to recover the loss. There is a possibility that, if KT, a dominant provider, reduce the price below marginal cost or average cost for a certain period of time, it would obtain a significant share of market and make competitors exit. Despite intended exits, however, KT would not increase its service price unless the market comes to monopoly. The reasons are as follows: First, even though it may succeed in excluding new entrants or marginal competitors, to make the second or third companies exit would be difficult. It is possible that survivors from competition would make KT harder to increase price by taking subscribers away from KT and make KT fail to raise profits even after a price increase. Second, SOs have been increasing their market share by offering cheaper services surrounding certain areas (which are mostly their franchising areas). However, KT has responded with quality and service competition to this competitive pressure rather than price competition. Once KT competes with SOs in price, KT should bring down its own price. In this case, the whole profits KT can obtain would be diminishing, although it could take subscribers away from SOs.

On the other hand, if KT competes in a certain area with quality, value-added services, and giveaways, KT may lure more new subscribers away without influencing the revenue derived from the existing customers. Considering the facts, we can assume that the incumbent provider would compete with quality and service rather than with price by engaging in predatory pricing. KT would have more incentive to raise rivals costs by increasing prices of transmission and land lines for rent rather than predatory pricing. This is analogous to the competition between DSL and cable companies in the U.S.

Step 8. Assessment of entry impediments

In the broadband access market of South Korea, the only discernable barrier to entry was nothing but obtaining a license. In the residential broadband access market, if a new entrant was going to enter nationwide on a large scale, barriers to entry would be much higher to entrants without economies of scale compared to entrants with economies of scale. On the other hand, entry barriers would be rather low to an entrant that tries to enter on a small scale like value-added or special service providers that can lease facilities from the facilities-based operators.

In contrast, it is notable that the U.S. has much higher barriers to new entrants that want to enter on either DSL or cable network platforms. Even though wireless, satellite and BPL have provided alternative technologies to new entrants, entering the residential market without economies of scale and scope as like early entrants, and without regulatory certainty would be too risky to decide to enter.

5. Conclusion

This paper has shown some commonalities and differences between the U.S. and South Korea in terms of entry barriers in the broadband access market. In particular, the following differences are conspicuous and deserve to be mentioned:

First, the qualifying speed of broadband is very different between the U.S. and South Korea. Although the U.S. definition, i.e., at least 200 kbps in one direction can have the effect of expanding the relevant market, the broadband content and applications markets have been limited by accommodating the speed. However, it is well-known that the speedier access service in South Korea has resulted from the effect of vigorous market competition rather than the government's requirement (Lau, Kim and Atkin, 2005; Lee & Chan-Olmsted, 2004).

Second, in South Korea, reciprocal access to networks of each other has been easier than in the U.S. Mandated open access rules have been taken advantage of by new entrants in South Korea and led to more concrete competition among intermodal and intramodal providers. When companies vigorously compete against one another, they have incentives to beat the competition through lower prices and are driven to make the investments necessary to improve quality or develop new services. The market forces firms to invest and price aggressively, for fear of falling behind. Vigorous competition ensures that we all pay fair prices for the goods and services we enjoy. Unfortunately, the telecommunications marketplace in the U.S. is anything but competitive (Cooper, et al., 2005).

Third, more than three providers have always been available to Korean residential users. Although the US and South Korea share a commonality of insufficient entrance of a third platform, they are different in terms of competition levels. The existence of more than three providers for residential users has not only provided more options to customers but also created more competitive pressure.

Fourth, the Korean government's protection policy makes new entrants face rather low barriers to entry. The Korean government has thought that at least three competitors need to exist in a market and leveraged KT, once a public company, to provide collocation facilities and essential facilities to new entrants to restrain the dominant market power of KT.

In particular, Lee and Chan-Olmsted (2004) conclude that facility-based competition seems to work better than simple local loop unbundling in inducing competition in South Korea. Thus, the authors suggest that policies that encourage the development of alternative broadband technologies and introduce a collaborative governmental role in the building of major broadband infrastructure might be effective in speeding up the deployment of broadband Internet. It is evident that the market competition is more influential than government's command control but, as shown in the South Korean case, what is more important is how the government can assist in incubating viable competition (Frieden, 2005).

Barriers to entry exist under very diverse conceptions about what they are depending on the views of different economists and scholars. Although the Stiglerian conception of entry barriers has been more precisely defined as focusing on cost differentials between entrants and incumbents, the Bainian approach is more applicable for investigating barriers in the telecommunications market. Because, first, economies of scale, sunk costs, and advertising are critical sources of barriers to entry in the telecommunications network industry and second, these will all be excluded under the Stiglerian approach. How these barriers influence the entry

decisions of new potential entrants has not been apparent. By empirical evidence from previous literature, we can assume that the barriers will vary depending on the scale of entrance, potential local demands, and specific characteristics of the market. Also, as far as there are incumbents with economies of scale and sunk costs, their responses to potential entrants will be erecting strategic barriers through advertising and service/quality competition rather than price reduction in the telecommunications market.

The Telecommunications Act of 1996 mandates that the FCC eliminate and identify market entry barriers “for entrepreneurs and other small businesses in the provision and ownership of telecommunications services and information services, or in the provision of parts or services to providers of telecommunications services and information services.”²⁵ Therefore, the Commission has a statutory duty and an obligation in the public interest to identify and eliminate market entry barriers for small telecommunications businesses. In general, the Commission has interpreted market entry barriers to include, *inter alia*, “barriers that impede entry into the telecommunications market by existing small businesses, and obstacles that small telecommunications businesses face in providing service or expanding within the telecommunications industry”

Above all, barriers to entry is a very important issue at the moment in that the US has adopted non-open access rules in advanced telecommunications networks which deliver high-speed Internet to residence areas and ruled out most small scale non-facilities based providers. Even though wireless, satellite and other access technologies have been said to be able to overcome the last mile problems, they may still face entry barriers. The residential broadband market has been called monopoly or at best, duopoly for a long time thanks to the enormous height of entry barriers such as scale economies and sunk costs, which come from burdensome underground wiring and essential facilities.

Generally, big companies can overcome certain barriers to entry more easily (e.g., economies of scale) and they may be able to influence the competitive positions in an industry to a greater extent than smaller companies can. Small companies are often the first and most directly affected by the harm caused by price fixers and market allocators or anticompetitive behavior of incumbents (Golodner, 2001). The size of the entry (in terms of new production capacity), thus, influences the consequences for the incumbent. Incumbents might allow small entrants or fringe companies in the market in order to keep bigger competitors out of the market. If an entrant enters with a large production capacity, it poses a serious threat to the incumbents. In such circumstances, incumbents are more likely to react aggressively to the entrant, for example by lowering their prices. Therefore, the size of the (potential) entrant is expected to influence the reaction of the incumbents. Barriers to entry have an effect on the entry decision of potential entrants as well. If the barriers to entry are too high, small firms or start-ups might decide not to enter the market. This might have a negative effect on competition and on the dynamics of the market, and might result in high prices and/or low quality and innovation.

A more recent study about Internet Service Providers (ISPs) (van Gorp, Maitland, & Hanekop, 2006) reveals the challenges ISPs face and their responsive strategies. By examining the Dutch broadband market and surveying European ISPs, it found that ISPs’ offerings of broadband services are more likely to be driven by competitive forces than by proactive

²⁵ 47 U.S.C. § 257

strategies, although most ISPs started their role as a technological mediator in the market. Interestingly, they conclude that ISPs' position in the market is likely to be threatened by infrastructure providers when infrastructure providers come to be aware of the potential of Internet access and expand their service areas. The market power of infrastructure providers will bring further competitive pressure on independent ISPs in the broadband access market in the future.

Thus, this study raises another question, in increasing market competition, whether or not independent ISPs will be able to gain enough market share in fixed Internet access services. The challenges ISPs face indicate the increasing importance of owning facilities or network infrastructure in the broadband age (Andy Ng, et al., 2004). Andy Ng, et al. (2004) studies the industry structure of the residential broadband market and argues that owning the optical last mile network is strategically important because of its monopolistic nature and the technical scalability to meet future bandwidth demand. As a result, the last mile operator will seize substantial market power in the broadband service value chain (Andy Ng, et al., 2004).

High degrees of entry barriers from high customer acquisition costs and economies of scale in network operations in the local telecommunications market induce the strategy of buying or acquiring existing telephone companies rather than building a new network. If there is an industry that firms can only enter if they make a large capital expenditure, a firm will not enter if the profits that it anticipates in the long run will not be sufficient to justify the initial capital requirement. Therefore, as shown in the transaction between GTE and CenturyTel in 1999, new entrants are often willing to pay a premium for the purchase of networks and customers (Gabel, 2002). Although new entrants with facilities such as wireless, powerline and satellite may come from the existing companies with deep pockets, to overcome barriers, e.g., enormous capital requirements, economies of scale and sunk costs of residential telecom networks would not be that easy. Despite the market expansion of various broadband access technologies, it seems unclear whether new entrants with facilities gain enough post-entry profits to compete with incumbents in the residential broadband access market and how new entrants without facilities are ever going to enter the market without a way to access residential users. xDSL or cable modem, duopoly-centered policies can give more advantages to certain access platforms, and to duplicated investment.

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