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**BARRIERS TO ENTRY ANALYSIS OF BROADBAND MULTIPLE
PLATFORMS: COMPARING THE U.S. AND SOUTH KOREA**

A Thesis in

Mass Communications

by

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ABSTRACT

This study intends: to clarify the various economic factors that could prevent or make it difficult for new entrants based on multiple platforms (i.e., xDSL, Cable modem, wireless, BPL, and satellite) to successfully enter the residential broadband access market; to compare the U.S. and South Korea in terms of barriers to entry to identify their differences and to explain how those differences have affected the level of market competition in each country; and to discuss the implications of the barriers to entry in terms of future competition and regulatory policies in the US broadband access market.

To accomplish those objectives, both a comparative case study based upon government documents and industry data, and an executive survey and interview analysis were conducted. The findings are: theoretically, a broadband network requires substantial sunk investment, economies of scale and economies of scope. Positive post-entry profitability, entry costs, regulation and competition policy greatly influence the decision for new entry. The most important entry barriers in the residential broadband market in the U.S. are seemingly the access to the last mile, economies of scale, economies of scope and capital requirements. In South Korea, new entrants do not have much difficulty accessing the last mile by virtue of the government's new entrants-favorable competition policy such as open access and line sharing rules although the last mile operators seize substantial market power in the broadband service value chain in both countries. In contrast, the FCC's policy directions have been oddly against reducing barriers to entry for new entrants and small businesses. As for new entrants without facilities who utilize wired options, such as xDSL and cable modems, access to the last mile and predatory

pricing are the most important barriers. Still, a large portion of new entrants have entered the market utilizing ADSL since 1999 in the U.S. As for new entrants with facilities using other alternative technologies, technological barriers, such as frequency interference and congestion, and economic barriers, such as spectrum costs and capital requirements, have been critical entry barriers.

An executive survey of broadband access providers revealed that entry costs were the most important barriers among four factors, i.e., entry costs, absolute cost advantages, product differentiation and post-entry profitability. Interviewing executives produced five main themes: access to the incumbents' networks, incumbent phone companies' predatory retail pricing & overpricing access, political power of incumbents biasing the regulation and legislation, difficulty in access to capital due to regulatory uncertainty, and financial and technological limitations of alternative access technologies. Increasingly high barriers to entry to new entrants in xDSL and cable modem services are significant in the U.S. compared to those in South Korea. Even though alternative access technologies are available, new entrants with these technologies are more likely to have high entry barriers in terms of capital requirements and lack of profitability. Regulators should recognize how much more difficult it would be to enter the residential market with only the power of capital despite tremendous competitive advantages the incumbent telephone companies and cable companies have benefited from complete control of the last mile networks for decades.

TABLE OF CONTENTS

LIST OF FIGURES	viii
LIST OF TABLES	ix
ACKNOWLEDGEMENTS	xi
Chapter 1 Introduction	1
1.1 Background Information.....	1
1.1.1 Facilities-based competition and deferred entrance of the third competitor.....	5
1.1.2 The FCC’s deregulation and barriers to entry	9
1.1.3 Broadband Success in South Korea.....	12
1.2 Inquiries and Rationale	17
1.2.1 Research questions	17
1.2.2 Significance of the study	20
1.3 Organization of the Dissertation	21
Chapter 2 Literature Review.....	23
2.1 The Broadband Market in the U.S. and South Korea	23
2.1.1 The U.S.....	23
2.1.2 South Korea	28
2.2 Comparison: Commonalities and Dissimilarities	33
2.3 Telecommunications Infrastructure and Barriers to Entry	38
2.3.1 Barriers to entry in the telecommunications market.....	38
2.3.2 Determinants of market entry in local telecommunications markets ...	41
2.3.3 Incumbents’ strategies for deterring new entry	46
Chapter 3 Theoretical and Methodological Approaches	48
3.1 Theoretical Approach	48
3.1.1 Historical debates on the definition of entry barriers	48
3.1.2 Bain’s structural barriers and Stigler-and-Chicago School’s barriers..	49
3.2 Analytical Framework: Evaluation of the Presence of Barriers to Entry	57
3.2.1 Step 1: Market definition and entry by production substituters	58
3.2.2 Step 2: Market conditions and historical entry.....	59
3.2.3 Step 3: Assessment of absolute (cost) advantages	60
3.2.4 Step 4: Sunk cost, economies of scale and capital requirements	61
3.2.5 Step 5: Product differentiation, advertising, switching costs and network externalities	62
3.2.6 Step 6: Vertical foreclosure and exclusion.....	63
3.2.7 Step 7: Predatory behavior	65

3.2.8 Step 8: Assessment of entry impediments.....	65
3.3 Methodological Approach.....	67
3.3.1 Comparative case study.....	67
3.3.2 Empirical investigation.....	68
Chapter 4 Analysis: The Broadband Market and Barriers to Entry.....	70
4.1 Market Definition and Production Substituters.....	70
4.2 Market Conditions and Historical Entry.....	72
4.2.1 The U.S.....	72
4.2.1.1 xDSL.....	77
4.2.1.2 Cable modem.....	83
4.2.1.3 Wireless residential broadband.....	84
4.2.1.4 Broadband over power line (BPL).....	93
4.2.1.5 Satellite.....	99
4.2.2 South Korea.....	101
4.3 Assessment of Absolute Cost Advantages.....	107
4.4 Sunk Cost, Economies of Scale and Capital Requirements.....	112
4.5 Product Differentiation, Advertising, Switching Costs and Network Externalities.....	114
4.5.1 Brand recognition.....	116
4.5.2 Switching costs.....	117
4.5.3 Network externalities.....	118
4.6 Vertical Foreclosure and Exclusion.....	118
4.7 Predatory Behavior.....	122
4.8 Assessment of Entry Impediments.....	123
4.9 Conclusion.....	124
Chapter 5 Reality Check: The Presence and Perceived Importance of Barriers to Entry in the Residential Broadband Market.....	128
5.1 Introduction.....	128
5.2 Research Objectives.....	129
5.3 Literature Review.....	130
5.3.1 Barriers to entry in the telecommunications market.....	131
5.3.2 Previous analyses of barriers to entry in several industries.....	132
5.4 Methodology.....	134
5.4.1 Survey: data collection.....	134
5.4.2 In-depth interview.....	138
5.5 Analyses and Findings.....	139
5.5.1 Perceived importance of barriers to entry.....	140
5.5.2 Underlying dimensions of barriers to entry.....	141
5.5.3 Interview analysis.....	148
5.6 Discussion and Conclusion.....	164
5.7 Limitations and Future Research.....	167

Chapter 6 Conclusion.....	169
6.1 Findings of South Korea-U.S. Comparison.....	169
6.2 Policy Implications and Concluding Remarks	173
6.3 Limitations and Suggested Further Studies	180
Bibliography	183
Appendix A Survey Questionnaire	212
Appendix B Interview Questionnaire	216

LIST OF FIGURES

Figure 1-1: Comparison of the rank of the US and South Korea in broadband subscribers per 100 inhabitants.....	15
Figure 1-2: Broadband Internet service subscribers in South Korea by providers	16
Figure 2-1: Residential advanced services lines by technology as of June 30, 2006 (FCC, 2007b)	26
Figure 3-1: Evaluative steps to determine entry conditions.....	66
Figure 4-1: The growth rate of providers of high-speed lines by technology (The U.S.) (1999-2004).....	76
Figure 4-2: BPL in the last mile.....	94

LIST OF TABLES

Table 1-1: Broadband subscribers per 100 inhabitants, by technology, June 2005....	13
Table 1-2: Broadband Internet subscribers in South Korea (in 10,000 subscribers)..	16
Table 2-1: Top 21 U.S. ISPs by subscriber: the 2 nd quarter of 2007	24
Table 2-2: Various broadband technologies, summary	27
Table 2-3: Broadband Internet market shares in South Korea (%).....	31
Table 3-1: Various definitions of barriers-to-entry.....	49
Table 3-2: Bain's and Stigler's definitions of entry barriers	52
Table 3-3: Classification of entry barriers by McAfee et al. (2004).....	55
Table 4-1: Providers of high-speed lines by technology, the U.S. (Dec. 1999-June 2005).....	75
Table 4-2: Providers of high-speed lines by technology (June 2005-June 2006) (Over 200 kbps in at least one direction).....	76
Table 4-3: The list of US cities and regions with public broadband initiatives.....	91
Table 4-4: Broadband Internet market shares in South Korea (%).....	102
Table 4-5: High-speed Internet service subscribers (South Korea) 2006.....	103
Table 4-6: Comparison of barriers to entry by platforms in the U.S. and South Korea.....	125
Table 5-1: Interview questions.....	138
Table 5-2: Importance of barriers to entry in the residential broadband access market	140
Table 5-3: Rotated factor matrix showing the underlying dimensions of barriers to entry in the residential broadband market	143
Table 5-4: Participating interviewees by characteristics	149
Table 5-5: Reporting competitive local exchange carriers (end-user switched access lines in thousands).....	153

Table 5-6: Pre and post TRRO affects on product margins..... 161

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Chapter 1 Introduction

1.1 Background Information

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 power¹ of the incumbents. Since a variety of entry barriers to a market cause 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; Blees, et al., 2003).²

Broadband – high speed Internet – has been identified as a fundamental infrastructure in the 21st century, an equivalent of electricity (McChesney & Podesta, 2006). A single broadband connection can deliver not only the existing media such as telephone, television, radio and the Web all together but also new potential applications in the future, which are mostly unconceivable at the moment. We recognize well that broadband will be an indispensable part of economic, personal and public life. Thus, the universal deployment of broadband access is one of the hottest agendas in the world. It is

¹ Market power is defined as “the ability of a firm to alter the market price of a good or service. A firm with market power can raise price without losing all customers to competitors” (in Ch. 7 in Brickley, J. A., Smith, C. W., & Zimmerman, J. L. (2004). *Managerial Economics and Organizational Architecture* (the 3rd Ed.). New York: McGraw-Hill, cited in Wikipedia).

² Allocative efficiency indicates the market condition whereby resources are allocated in a way that maximizes the net benefit attained through their use. A firm is allocatively efficient when its price is equal to its marginal costs (that is, $P = MC$) in a perfect market. Productive efficiency is the highest possible output of one good, given the production level of the other good(s). In long-run equilibrium for a perfectly competitive markets, this is where average cost is at the lowest point on the Average Cost curve (Wikipedia definition).

often argued that delayed deployment can cause enormous harm to the economy and society of a country. Thus, regulators in the world have been trying to wipe away any regulatory or economic obstacles to ensure viable competition which will lead to universal access to the broadband Internet.

Recognizing the importance of competition for universal deployment, this thesis investigates entry barriers in residential broadband access service or retail high speed Internet service, which damage market efficiency and delay the acknowledgement of universal access.³ When it comes to a 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 a debate as to whether U.S. competition policy (i.e., the abolition of mandated open access rules to the incumbents' networks) results 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,⁴ WiMax⁵ and satellite have

³ Internet service is composed of Internet access service and network access service (or Internet connectivity service). While Internet access service can be distinguished based upon technologies (dial-up, ISDN, xDSL, cable modem, etc.) or transmission speed, it can be divided into either narrowband or broadband depending on transmission speed. This thesis focuses on both broadband and Internet access service.

⁴ Wi-Fi is basically a wireless local area network. Wi-Fi provides connectivity between mobile or distributed devices and existing networks, such as cable modem or DSL broadband connections (Mitchell, *n.d.*).

⁵ Worldwide Interoperability for Microwave Access. A standards-based wireless technology that provides high-throughput broadband connections over long distances. WiMAX is similar to Wi-Fi in concept, but has certain improvements such as better performance and much greater area of coverage than Wi-Fi (Abichar, et al., 2006; also see <http://en.wikipedia.org/wiki/WiMax>).

been promoted as would-be competitors in the foreseeable future.⁶ 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 reasonable to believe that the residential broadband market will be a *dominant-fringe cluster* model because of the structure of two dominant leaders in each cluster, Incumbent Local Exchange Carriers (ILECs)⁷ and cable Multiple System Operators (MSOs) with smaller entrants (Zhang, 2002). The incumbent sellers will initially retain large market shares with a fringe attempting to shave away the incumbents' 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 on how these new entrants with alternative technologies enter and serve the market and further, how the FCC's competition policy influences these new entrants in the long run. We only speculate 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. In addition,

⁶ The FCC divides 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 power line; and satellite and terrestrial wireless systems, which use radio spectrum to communicate with a radio transmitter" (FCC, 2005, p.13).

⁷ An ILEC (incumbent local exchange carrier) is a telephone company in the U.S. that was providing local service when the Telecommunications Act of 1996 was enacted. The ILECs include the former Bell operating companies (BOCs) which were grouped into holding companies known collectively as the regional Bell operating companies (RBOCs) when the Bell System was broken up by a 1983 consent decree. The ILECs are in contradistinction to CLECs (competitive local exchange carriers). A "local exchange" is the local "central office" of an LEC. Lines from homes and businesses terminate at a local exchange. Local exchanges connect to other local exchanges within a local access and transport area (LATA) or to interexchange carriers (IXC) such as long-distance carriers AT&T (merged with SBC in 2005), MCI (merged with Verizon in 2006), and Sprint. *What is definition*. Retrieved Jan. 20, 2006, from http://searchnetworking.techtarget.com/sDefinition/0,,sid7_gci214021,00.html

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 incumbents, wireless ISPs and municipal governments shows its possibility.

On the other hand, increasing concern about lagging behind other countries in terms of the broadband penetration rate has risen 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 successful penetration rates in the residential broadband market. The Korean government has enforced an unbundling mandate and line sharing rules on the incumbent network providers both in narrowband in the past and in broadband currently. Thanks to its more favorable policy towards new entrants, South Korea has enjoyed more viable competition in both intermodal and intramodal bases than that in the U.S. (Lau, Kim and Atkin, 2005; Han, Byun & Lee, 2005; Lee & Chan-Olmsted, 2004). Accordingly, the key inquiry in the case of South Korea is about the size of an entrant rather than its type, for example, whether it would be a small entrant who starts in a certain region and expands business over time or a nationwide entrant with a deep pocket regardless of the presence of facilities. As a result, the size of the entrant 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 come into sight as competitors in the market, just as in the U.S.

Thus, this thesis examines whether there are barriers to entry for new entrants to 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, it scrutinizes each broadband access platform in the U.S., especially focusing on wireless technologies, and this analysis is compared to that of South Korea.

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. Some observations and further detailed background information provide a solid rationale for this comparative analysis, as follows.

1.1.1 Facilities-based competition and deferred entrance of the third competitor

First of all, one observation is that, while the FCC has tried to bring a third competitor into the residential broadband market for the last decade, there is as yet no viable competitors to cable modem and DSL. When it comes to the broadband market for residential users, the FCC assumes that workable facilities-based competition is already occurring. In August 2005, when the FCC declared DSL an information service and released the incumbent DSL providers (mostly Incumbent telephone network operators) from the unbundling mandate in the broadband access market, the FCC stated, "...the record before us demonstrates that the broadband Internet access market today is

characterized by several emerging platforms and providers, both intermodal and intramodal, in most areas of the country” (FCC, 2005, August 5, p.4).⁸

In particular, the acknowledgment by the FCC of the development of broadband market competition has led to a series of recent deregulatory decisions. Since the late 1990s, cable operators have deployed cable modem technology. Mobile wireless providers are increasingly offering high-speed Internet access using technologies like Evolution-Data Optimized (EV-DO) technology. For example, Sprint has begun to roll out high-speed wireless data services using EV-DO technology. Satellite providers have deployed both Ku-band and even more advanced Ka-band technology that can offer high-speed Internet access service throughout the nation as well. Fixed wireless operators are planning to use licensed and unlicensed spectrum to deliver broadband services, and are developing new technologies that promise ubiquitous service and greater bandwidth. Other companies are also exploring the use of power lines, and of cables placed in gas lines, to provide broadband services (FCC, 2005, p.21).

However, despite the FCC’s continuing efforts to bring forth a third competitor into the broadband market, and rapidly emerging new broadband access technologies, most of residential and small business users in the U.S. still have only two options

⁸ Intramodal competitors are those competitive providers, such as Covad, whose services are either delivered partially or wholly over incumbent LEC facilities, or over wireline platforms using technology identical or similar to those which incumbent LECs have deployed. “Intermodal competitors” are providers of services similar to those provided by incumbent LECs that rely exclusively on technological platforms other than wireline technologies (FCC, 2005). As indicated in the FCC’s definitions of both intermodal and intramodal, the broadband platforms include wireline platforms deployed by incumbent local exchange carriers (ILECs) and cable system operators, wireless solutions such as fixed wireless and satellite, and broadband over power line (BPL). Since Congress enacted the Telecommunications Act of 1996 for the express purposes of promoting competition, reducing regulation, and encouraging the rapid deployment of new telecommunications, the FCC has been mandated to “ensure adequate incentives are in place to encourage the deployment and innovation of broadband platforms (FCC, 2005, p.4).”

available, either cable modem or ADSL lines (FCC, 2005b). As has been identified in academic studies, the broadband network at the last mile remains the most concentrated, the least competitive, and the best protected by barriers to entry (Yoo, 2004; Andy Ng, et al., 2004). Broadband providers today have few competitors. About half of all U.S. residents have the choice of two broadband providers, and the rest have one or none.⁹

The market dominance of ADSL and cable modems is clear in the FCC's official statistics. According to the FCC's most recent market reports from 1999 to 2004, ADSL has been encroaching on other access technologies so that the change of market share has been dramatic. Interestingly, the increasing penetration rate of ADSL has been far greater than that of cable modem for the last few years. For example, while the market share of coaxial cable access has slightly increased from 51.3% to 56.4%, ADSL's 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 power line have been rapidly decreasing (from 22.1% to 3.9% and from 11.3% to 1.8%, respectively). A combined satellite and wireless market share is only 1.5% of high-speed lines. And the power-line high speed line market share appears to be less than 1%. ILECs still represent about 96% of facilities-based ADSL high-speed lines in service as of Dec. 31, 2004.

When all technologies are considered, the ILECs still provide about 38% of high-speed connections to end users (FCC, July 2005). Thus, problems such as slower deployment and fewer choices in the residential broadband market compared to other countries have often been raised by consumer advocacy groups, commentators, academic researchers

⁹ The FCC found in 2004 that just 53 percent of Americans have a choice of broadband providers, 28 percent have one choice, and 19 percent have no choice (Bolen, 2006, Feb. 9).

and even politicians (Frieden, 2005a, 2005b; Cooper, 2005; Kimmelman, 2005; Besing, 2005; Bleha, 2005).¹⁰

Certainly the reasons current U.S. residents normally have only two options can be ascribed to several factors such as government regulation, slow entrance and legacy competitive advantages of the incumbents. Further, it is really hard to figure out how many competing firms are necessary to eliminate the market power of the incumbents in an industry (Xiao and Orazem, 2005). The reasons behind delayed entrance of wireless and BPL might be attributed to lack of consumer demand and the technologies' suitability for different market segments. According to an earlier study (Bright, 2001), satellite and fixed wireless services, which currently serve less than 2% of broadband customers, have been identified as promising access technologies in rural areas that are not served by DSL or cable modem-capable wires rather than in urban areas. Since technical and economic constraints prevent the widespread deployment of cable and DSL, especially in rural areas, satellite and fixed wireless providers will provide a location-neutral and cost-effective broadband service as a reasonable substitute for wire-based technologies.

Interestingly, despite the market segmentation, the FCC and academic researchers have assumed that these alternative technologies will put pressure on residential

¹⁰ Indeed, recently Senator Ted Stevens (R-Alaska) requested all of the industry representatives testifying in a panel discussion held in Congress to provide in writing the reason why universities and other countries routinely provide broadband speeds of up to 100 Mbps (megabits per second), while in the United States, speeds of 15 Mbps are considered elite (Bolen, 2006, Feb. 9). Vinton Cerf, a well known Internet Guru, testified in the same Congressional panel discussion, "The challenge we have is that there is not enough competition in the broadband world... alternative providers, such as broadband over power lines, occupy less than 2 percent of the market... meanwhile, places such as Hong Kong, Singapore, and Japan provide broadband speeds of 100 mbps for about \$50 per month, with no constraints on how bandwidth is used" (Bolen, 2006, Feb. 9).

broadband competition and bring forth better quality and service to end users (FCC, 2005; Flamm & Chaudhuri, 2005). However, these alternative technologies have never materialized as viable competitors in the residential broadband access market let alone the rural market, although these technologies have been around for a long time. That is, the alternative broadband platforms have been emerging but seem not yet widely available in the U.S. As the only significant providers of home broadband, the cable and telephone companies do possess unique market power in the U.S. But it remains to be seen whether they will maintain it as wireless broadband and other technologies mature.

1.1.2 The FCC's deregulation and barriers to entry

Since the 1980's deregulation movement, the FCC has adhered to a *Nascent Services Doctrine*, which posits that “the regulator should apply a heavy presumption against extending legacy rules to new services and technologies such as Voice over Internet Protocol (VoIP).¹¹ Instead, the regulator should foster the development of such services in a minimally regulated environment to promote facilities-based competition and other important goals” (Abernathy, 2005). Under this philosophy, the FCC has made a series of deregulatory decisions following a breakthrough Supreme Court judgment in the *Brand X* case, decided in July 2005 (NCTA v. Brand X, 2005). The Supreme Court decision freed cable television companies from having to share their networks with Internet service providers. The *Brand X* case has also provided the legal foundation for

¹¹ VoIP is a technology that allows telephone calls to be made over computer networks like the Internet. VoIP converts analog voice signals into digital data packets and supports real-time, two-way transmission of conversations using Internet Protocol (IP) (http://compnetworking.about.com/cs/voicefaxoverip/g/bldef_voip.htm).

the FCC to abandon most regulation of both telephone and cable television companies, based on the Supreme Court's endorsement of limited regulation for information service markets (Frieden, 2005b).

The FCC soon reclassified telephone company provided DSL service as an information service despite having previously identified it as a telecommunications service. Further, it ruled in August 2005 that the DSL services belong to the category of information service, which is outside of any regulation. Thus, the ILECs no longer have to lease their high-speed Internet lines to competitors (FCC, 2005, August 5).¹²

Additionally, the ILECs are permitted to bundle their voice services and high-speed Internet services. Thus, this secured a competitive advantage of DSL companies against other telecommunications providers, causing concern about tilting the competitive playing field towards the ILECs and against other smaller broadband providers (Frieden, 2005a, 2005b; Cooper, 2005; Kimmelman, 2005; Besing, 2005; Bleha, 2005; Scott & Aaron, 2005).

On the other hand, quite a lot of economists and commentators advocate the FCC's deregulatory decisions as allowing the incumbents to play on a level-playing-field and motivating both the incumbents and new entrants to invest and innovate on the assumption that facilities-based competition among different platforms is already viable (Flamm & Chaudhuri, 2005; Hazlett & Bazelon, 2005; Crandall, 2003; Owen, 2002; Lent, 2004).

¹² FCC Report and Order and Notice of Proposed Rule Making, Released September 23, 2005, FCC 05-150. The FCC's Order, however, requires facilities-based providers to contribute to existing universal service mechanisms based on their current levels of reported DSL revenues for a 270-day period after the effective date of the Order or until the Commission adopts new contribution rules, whichever occurs earlier.

It has been long debated whether or not old-fashioned government interventions such as mandatory network access rules need to apply to the broadband access market and especially, asymmetrically to telephone companies (Crandall & Alleman, 2002). Some empirical evidence shows that mandatory network access discourages investment in new and upgraded networks, thereby hindering development of alternative platforms and market competition (Hazlett & Bazelon, 2005; Lent, 2004; Crandall & Alleman, 2002). Also, governmental intervention very often can cause inefficiency of market dynamics (Spulber & Yoo, 2003; Stollman, 2005). Based upon this economic evidence, the FCC ended up determining to support facilities-based competition or intermodal competition rather than intramodal competition, by abolishing mandatory line sharing rules (e.g. from Unbundled Network Elements Policy—UNE-P).

Following the FCC's reasoning, a series of recent deregulatory decisions were intended to create great incentives for the incumbent providers to invest in next generation networks and bring innovation and resultant facilities-based competition between DSL and cable (See FCC, 2005, p.14). Although these deregulatory decisions certainly intend to facilitate market competition, it seems, ironically that they create higher barriers to both new entrants in case the entrants have no facilities of their own and existing companies that have leased the networks. Meanwhile, how these deregulatory decisions will affect new entrants with facilities such as wireless, BPL and satellite is not clear.

1.1.3 Broadband Success in South Korea

Since the introduction of broadband or high speed Internet for residential users in the late 1990s, the investment in broadband infrastructure has been proceeding rapidly and the number of people using broadband access technologies is increasing as well (OECD, 2005; ITU, 2005). Most of all, South Korea has been mentioned as an unprecedented success in terms of broadband penetration and at the same time, the speed of adoption (Aizu, 2002). Considering that Korean household Internet penetration was less than 5%, with 731,000 subscribers in 1996 (Aizu, 2002), the achievement of 71.8% of total households (12.5 million households out of about 15 million households) in March, 2006 was quite significant.

The current stage of Korea's Internet usage has surpassed a stage of extension, and has gone onto a stage of maturity and stability. As of December 2005, there are 33.01 million Internet users over the age of 6 and the usage rate is 72.8%. Korea now has world-class IT infrastructure such as broadband Internet and mobile communications.¹³ More interestingly, most of the Internet users (97.7%) used the Internet in their homes. Internet usage rate in companies (workplaces) and public facilities were 23.7% and 21.2% respectively (NCA, 2006).

The broadband status of the U.S. has been often compared to that of South Korea (Horrigan, 2005; Frieden, 2005; Han, Byun, & Lee, 2005; Lee & Chan-Olmsted, 2004; Wu, 2003; An, 2002). Conventionally, the number of broadband subscribers has been

¹³ Korean-made products based on broadband networks and IT technologies including semiconductors, mobile handsets, TFT-LCD, digital TV and Internet games have emerged as number one products on the global market.

used as an index to evaluate the quality of a country's informatization infrastructure because high speed Internet is an essential service for digital content development such as online games and video services. Despite the development of broadband access technologies at a breakneck pace, the current expansion of broadband Internet penetration varies across countries (OECD, 2005; ITU, 2005). A big disparity exist between the U.S. and South Korea in broadband users' percentage based upon total Internet users in spite of a similar starting point of service introduction in both countries (Table 1-1).

Table 1-1: Broadband subscribers per 100 inhabitants, by technology, June 2005

	DSL	Cable	Other	Total*	Rank	Total Subscribers
Korea	13.9	8.9	2.7	25.5	1	12 260 969
Netherlands	13.6	8.9	0	22.5	2	3 642 315
Denmark	13.2	6.1	2.4	21.8	3	1 176 637
Iceland	21.0	0.3	0.4	21.7	4	63 553
Switzerland	12.7	7.2	0.4	20.3	5	1 515 446
Canada	9.4	9.7	0.1	19.2	6	6 142 662
Finland	16.3	2.2	0.2	18.7	7	978 600
Belgium	11.0	7.3	0	18.2	8	1 899 652
Norway	14.8	2.5	0.9	18.2	9	836 060
Sweden	11.3	2.7	2.5	16.5	10	1 482 843
Japan	11.0	2.4	3.0	16.4	11	20 953 090
United States	5.5	8.0	1.1	14.5	12	42 645 815
United Kingdom	9.7	3.8	0	13.5	13	8 095 000
France	11.9	0.8	0	12.8	14	7 935 900
Austria	7.0	5.4	0.1	12.5	15	1 025 036
Luxembourg	10.4	1.3	0	11.8	16	52 920
Australia	8.5	2.4	0.1	10.9	17	2 183 300
Germany	9.9	0.3	0.1	10.2	18	8 439 732
Italy	9.4	0	0.6	10.0	19	5 783 319
Portugal	5.1	4.7	0	9.9	20	1 031 491
Spain	7.0	2.2	0.1	9.3	21	3 949 234
New Zealand	6.4	0.3	0.3	6.9	22	283 798
Hungary	2.9	1.6	0.1	4.6	23	469 186

Ireland	3.5	0.4	0.5	4.3	24	175 500
Poland	2.5	0.7	0.1	3.3	25	1 250 000
Czech Republic	1.8	1.0	0	2.8	26	284 200
Slovak Republic	1.2	0.3	0.1	1.6	27	86 958
Turkey	1.1	0	0	1.2	28	862 843
Mexico	0.8	0.2	0	1.0	29	1 051 854
Greece	0.8	0	0	0.8	30	93 287
OECD	7.2	3.8	0.8	11.8		136 651 000

Although the U.S. played a significant role in the birth of Internet and its advanced technological infrastructure, the country that currently boasts the greatest penetration rate and faster development of broadband applications for last few years is not the U.S. In fact, the U.S. has been scored by international organizations as lagging behind many other European and Asian countries. In April 2005, the International Telecommunication Union (ITU) announced that the U.S. dropped from 13th to 16th place in global broadband penetration, lagging behind the telecom policy prowess of such countries as Canada, Israel, and Norway. The Organization for Economic Cooperation and Development (OECD) found similar results, with the U.S. tumbling from 4th place in 2001 to 12th by June 2005. Even more telling, the World Economic Forum's Networked Readiness Index (NRI), a global assessment of national telecommunications laws, technology usage, and the maturity of the telecom industries, found that the U.S. fell from 1st place in 2003-2004 to 5th place in 2004-2005 (cited in Vasquez, 2006). Regarding the

broadband penetration, the U.S. rank is not elevating the scale but is cascading down

(Figure 1-1).¹⁴

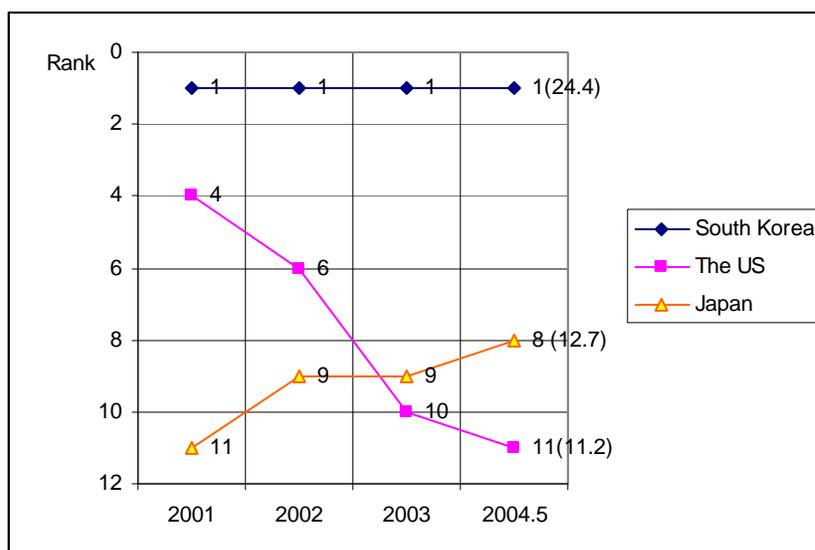


Figure 1-1: Comparison of the rank of the US and South Korea in broadband subscribers per 100 inhabitants

Source) OECD Communications Outlook 2005

In contrast, South Korea has consistently been the global leader in broadband Internet deployment since 1999. South Korea now faces saturation of its market and is migrating towards a more advanced *ubiquitous network society* (ITU, 2005b).¹⁵ Although household penetration of broadband service is already in the 80% range, analysts believe that there is still room for additional growth as regional discrepancies persist: broadband is not yet regarded everywhere as a universal public service like local telephony (KISDI, 2005; Table 1-2; Figure 1-2).

¹⁴ This situation has brought fear of ‘lagging behind’ among many Americans (Bleha, 2005). One FCC commissioner states, “...broadband is in the ditch, and we better figure out a way to get it out” (Plas, 2006, April 5).

¹⁵ The concept of a ubiquitous network society implies a world in which information, and the tools to exploit it, is available anytime, anywhere, by anything and anyone. A ubiquitous network society is thus the logical, long-term outcome of the drive to create Information Societies, as espoused by the World Summit on the Information Society (ITU, 2005b, p.5).

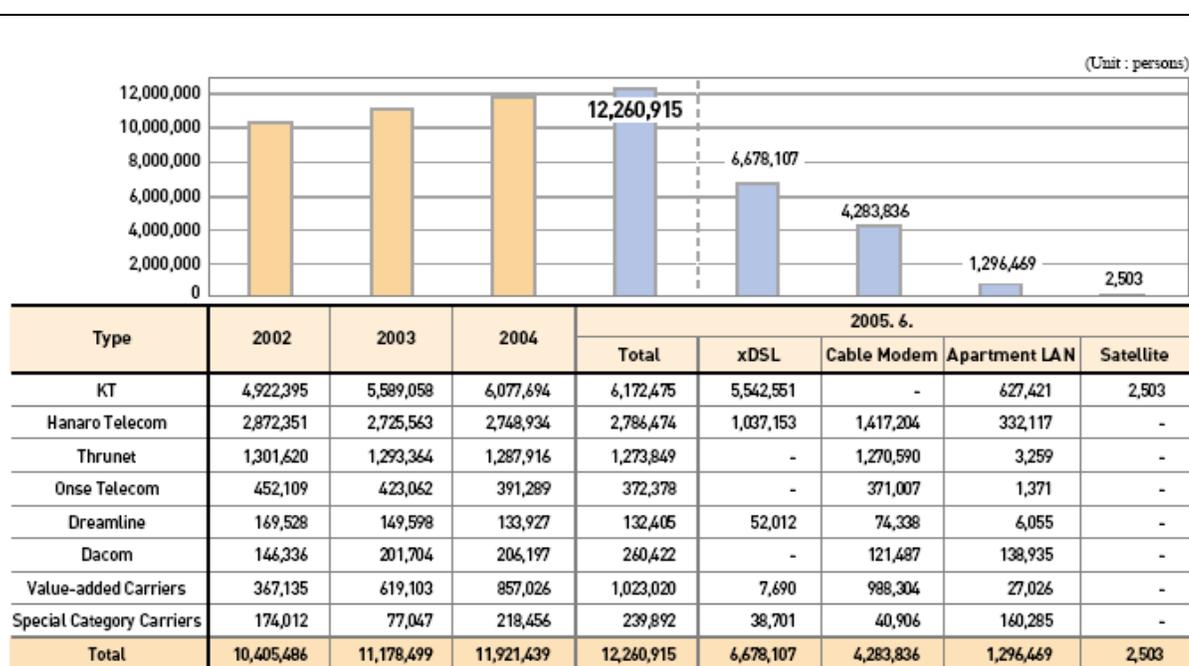
Table 1-2: Broadband Internet subscribers in South Korea (in 10,000 subscribers)

	2002	2003	2004
Broadband Internet	1,041	1,118	1,190
Household Penetration	69.1%	73.1%	76.6%

Note: 1. Number of subscribers is aggregation of ADSL, cable modem, and satellite based services.

2. Statistical and forecast data for households from Korea National Statistical Office.

3. 2002 from Korea Association of Information and Telecommunication, 2003 from MIC, and 2004 from KISDI forecast.



Source : Ministry of Information and Communication, July 2005

Note : 1. Number of wireless LAN IDs: 475,000 (436,000 for KT and 39,000 for Hanaro Telecom)

2. Apartment LAN indicates LAN type Broadband Internet connection using telephone line or UTP cable provisioned for apartments or housing complexes

Figure 1-2: Broadband Internet service subscribers in South Korea by providers

Despite 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, as in other countries. The alternative platforms' market shares have been meager in spite of lingering hypes. Rather, they have been regarded as

complementary convergence access technologies to the incumbents rather than as competitive technologies (Koh, Lee, & Kim, 2005). The US and South Korea share a commonality of insufficient entrance of the third platform. South Korea has, however, more concrete competition among intermodal and intramodal providers. The difference may be caused by different regulatory treatment for the incumbents, which will be discussed further in the next chapters.

1.2 Inquiries and Rationale

1.2.1 Research questions

As previously discussed, comprehending what kinds of barriers to entry exist for new entrants in the broadband market suggests much to policy makers. Explicitly identifying the presence of barriers to entry and their characteristics is very important not only for systemic 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. Thus, exploring how new entrants have struggled to enter the market and, once entered, how well they have been doing guides this thesis, based on the following research questions:

Research Question 1: What barriers to entry exist for new entrants in the residential broadband access market?

The goal of research question 1 is to clarify the various factors that could prevent or make it difficult to successfully enter the residential broadband access market. First, it addresses entry barriers generally, taking into consideration multiple broadband platforms embracing currently feasible access technologies, such as wireless, power line and satellite. Wireless will be discussed more in depth because wireless alternative technologies such as Wi-Fi mesh networks and WiMax have been promoted as the most promising competitors in the foreseeable future, thanks to the cost effectiveness of wireless technologies.

Research question 2: How have these barriers to entry had an impact on the actual entrance of broadband providers in both countries over time? For example, how have these barriers to entry affected entry into the residential wireless broadband access market?

This question is related to the record of entry and exit in the residential broadband access market. Since the late 1990s, ISPs including the incumbents in both countries have vigorously started to provide broadband service depending on their own platforms and access technologies. The Telecommunications Act of 1996 explicitly creates three ways for competitors to enter: resale, unbundled network elements, and facilities-based competition. The Act envisions firms starting with resale, then building part of their own network and renting unbundled network elements, and finally building their own local network. Thus, the answer to this question reveals what types of entrance have been occurring in the broadband access market.

Research Question 3: How are entry barriers different by the type of entrance (either entrance with facilities or entrance without facilities)?

According to the entry barriers theory, there are two main types of entrants. The first are firms entering the market for the first time by establishing new businesses. The second type of entrants is preexisting firms entering the market by expanding their markets or moving into a new type of business, which is called *barriers to mobility*. However, the barriers are typically the same in both cases (van Kranenburg, 2002, cited in Picard & Chon, 2005, p. 169). It is notable that, in the residential broadband market, most of the new entrants are preexisting companies that have already been in the narrowband market or other markets, for example, satellite broadcasting companies that provide broadband services. Thus, the type of entrant will be either an entrant with facilities such as wireless, power line and satellite or an entrant without facilities such as independent ISPs. For example, when the existing narrowband ISPs are moving in to the broadband market by leasing networks from incumbents, it should be counted as entrants without facilities. This distinction can be interpreted as an entrant with a small scale and an entrant with a nationwide scale in South Korea.

Research Question 4: What are the differences between the US and South Korea in entry barriers in the residential broadband market? How are the entry barriers of the U.S. broadband market different from the entry barriers of the South Korean broadband market?

This question leads to a comparison between the two jurisdictions and helps explain the dynamics of market competition in both countries. How have new entrants with alternative broadband platforms entered the residential broadband market in the U.S. and South Korea over time? What have been their entrance strategies?

Research Question 5: What can be learned from this barriers-to-entry analysis for the future broadband policy and market development?

As a result, we need to inquire into the lessons or implications of this entry barrier analysis and the comparison between the two countries for future broadband policy and market development.

1.2.2 Significance of the study

Although barriers to entry analysis has been regarded as a useful tool to signal market power in an industry, a review of the literature reveals that little research has been conducted in this area. Although there have been subsequent academic efforts put in place to examine the broadband markets in the two different jurisdictions, most studies have attempted to articulate factors causing the faster penetration rate in South Korea's broadband market compared to the U.S. (Han, Byun and Lee, 2005; Lau, Kim and Atkin, 2005; Lee & Chan-Olmsted, 2004; Ozanich, Hsu, & Park, 2004; Lee, O'Keefe and Yun, 2003; An, 2002).

Most of this literature ascribes South Korea's broadband success to geography, government policy, fiercer competition and cultural difference compared to the U.S. No

systematic analysis has ever been conducted from a market structural perspective applying a barriers-to-entry theory. Furthermore, a comparative analysis of barriers to entry into the broadband market focusing on economic, policy and market variables in both countries would offer important insights into market dynamics, pricing, and by extension penetration. Also, this thesis explores how entry has been or is actually taking place in the U.S. and South Korea over time. Thus, examining how theoretical barriers to entry have affected actual entrance over time sheds light on further understanding the current broadband market and predicting future entry.

1.3 Organization of the Dissertation

This thesis comprises six chapters. Chapter 1 reviews background information about broadband development in the U.S. and South Korea and relevant literature on the subject matter. More importantly, the research questions and rationale for the questions are introduced in this part. Chapter 2 is devoted to a literature review consisting of three parts: a brief introductory description about broadband markets in the U.S. and South Korea, reviews of previous comparative studies, and barriers-to-entry studies. With the focus on the broadband market in the U.S. and South Korea, reviews of economic and political factors which can influence the entrance of new broadband platforms are considered in Chapter 2. Chapter 3 discusses the theoretical background, the analytical framework, and methodological approach for this study including the scope and limitations. Chapter 4 comprises a barriers-to-entry analysis of the U.S. and South Korea based upon a wide variety of documents. The primary concern of this part is to examine

what kind of entry barriers can be identified for each alternative platform provider. This part is mostly a comparative case study depending upon the factors adopted from a barriers-to-entry framework identified in the previous chapter. That is, (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, and (8) entry impediments such as certification requirements and required time to build up brand name. Chapter 5 is devoted to further investigating the importance of entry barriers perceived by company executives in the broadband market by conducting a survey and interviews. This Chapter also suggests what roles the government should take to remove entry barriers. Chapter 6 is the final chapter. It summarizes the preceding case study and the comparison results. It concludes this thesis by discussing the implications of these findings, and suggesting limitations and further studies.

Chapter 2 Literature Review

2.1 The Broadband Market in the U.S. and South Korea

2.1.1 The U.S.

Explosive Internet growth in the late 1990s dramatically affected the evolution of computer networking. High-speed home networking struggled to get off the ground in 1997 and 1998. Cable modem service was the first broadband option available to many, but only a few hundred thousand subscribed to Internet cable in that first year. In 1999, competition from DSL began to take effect, but DSL availability remained quite limited at first. The expected competition from satellite broadband services did not emerge until today in 2006 even though it started to make its service available in the local market¹⁶; satellite services remain a distant third in the residential broadband market. It took until 2001 for home broadband to enter mainstream usage and begin growing at a faster rate than Internet dial-up services (Mitchell, *n.d.*). The FCC started to report the statistics on broadband deployment in 1998.

Broadband technology constitutes a disruptive, supplanting technology that threatens current ILECs and cable TV providers. Its rates of technical change and

¹⁶ With the highest monthly subscription fees and the most expensive installation and equipment charges, satellite companies captured less than 2 percent of the market by the end of 2001 (Thierer, 2002). *Jupiter Research* estimated that *Hughes Direcway*, a satellite broadband, has a total of 0.3% market share in terms of the number of broadband subscribers in the 2ND quarter of 2007 (Goldman, 2007, September 13).

absolute performance levels far exceed those currently provided by monopoly incumbents. Thus, it could change the telecommunications industry's economics and structures dramatically, placing serious pressure on the incumbents' business models.

Despite the prospect, however, the victory of incumbents over struggling new entrants summarizes the present situation of the broadband business and industry structure. In most countries, the incumbent fixed line operator has emerged as the dominant provider, though not always the first-mover in the market (ITU, 2003). The U.S. is not an exception to this rule. The problem is that this new technology must be deployed in territory occupied by the existing infrastructure such as cable or telephone networks and so, it is hard for new entrants to enter the market safely without confronting the political and economic power of the incumbents (For details about incumbent companies' vested interests and their power, refer to Ferguson, 2004).

A market research (Goldman, 2007, Sept. 13) reports top 20 ISPs in the U.S. broadband market based on the number of subscribers as of June 30, 2007 (Table 2-1). It shows that the top five ISPs (SBC, Comcast, AOL, Verizon and Road Runner (counting Time Warner twice)) have a combined market share of 56.5 percent. The combined market share of ISPs ranked 6 through 21 is 19.4 percent. As indicated in the table, a few corporations have been consolidating their control over the Internet access market.

Table 2-1: Top 21 U.S. ISPs by subscriber: the 2nd quarter of 2007

Rank	ISP	Subs (millions)	Market Share	Data & Source
1	SBC (AT&T) (Business and consumer DSL, ISDN, U-Verse,* and Satellite)	17.3	17.5%	7/24/2007, Press Release (http://www.att.com/Investor/Growth_Profile/download/wireline.xls)
2	Comcast (cable broadband)	12.4	12.6%	7/24/2007, SEC 10-Q
3	America Online (all U.S. AOL brand accounts)	10.9	11.1%	8/1/2007, Trending Schedules (http://ir.timewarner.com/downloads/Trending_080107.pdf)
4	Verizon (FiOS and DSL)	7.7	7.8%	7/31/2007, SEC 10-Q
5	Road Runner (cable broadband, business and residential)	7.5	7.5%	8/1/2007, Trending Schedules (http://ir.timewarner.com/downloads/Trending_080107.pdf)
6	EarthLink (DSL, dialup, cable, satellite, PLC and webhosting- SK EarthLink and some other business lines not included)	4.3	4.4%	8/7/2007, SEC 10-Q
7	Charter (cable broadband)	2.6	2.6%	8/2/2007, SEC 10-Q
8	Quest (DSL only)	2.4	2.4%	8/1/2007, SEC 10-Q
9	Cablevision (cable broadband)	2.2	2.2%	8/8/2007, SEC 10-Q
10	United Online (counting paid access only)	2.0	2.0%	8/9/2007, SEC 10-Q
11	Embarq (DSL only, formerly part of Sprint)	1.2	1.2%	8/1/2007, SEC 10-Q
12	Windstream (DSL only, formerly ALLTEL and Valor)	.75	0.8%	8/8/2007, SEC 10-Q
13	Insight BB (cable broadband)	.67	0.7%	8/15/2007, SEC 10-Q
14	Mediacom (cable broadband, dialup, and SMB broadband)	.61	0.6%	8/8/2007, SEC 10-Q
15	Covad (broadband only)	.55	0.6%	8/2/2007, SEC 10-Q
16	CenturyTel (DSL only)	.50	0.5%	8/2/2007, Press Release (http://media.corporate-ir.net/media_files/irol/11/112635/releases/SecondQuarter2007Earnings.pdf)
17	Citizens (DSL only)	.48	0.5%	8/1/2007, Press Release
18	Hughes DIRECWAY (satellite broadband)	.26	0.3%	Jupiter Research estimate (http://www.jupiterresearch.com/bin/item.pl/research:service/59/)
19	LocalNet (dialup)	.26	0.3%	ISP-Planet article (reconfirmed by email on June 28, 2007) (http://www.isp-planet.com/investor/2005/localnet_corecomm.html)
20	First Communications (DSL, BPL, dialup, both business and residential)	.24	0.2%	Company website (http://www.firstcomm.com/contact/aboutus.asp)
21	Cincinnati Bell (DSL only)	.21	0.2%	8/7/2007, SEC 10-Q
22	Other U.S. ISPs	23.8	24.1%	

Source) Goldman (2007, Sept. 13) at ISP-Planet, retrieved Nov. 2, 2007, from <http://www.isp-planet.com/research/rankings/usa.html> * SBC U-verse is an IP-based service that includes integrated television, high-speed Internet access and VoIP services.

If we see the residential broadband access market by technology, a majority of U.S. broadband users still access the high-speed Internet by DSL or cable modem that is usually provided by incumbents, although other available technologies have been increasing from 1.2% in 2005 to 4.8% in 2006 (Figure 2-1, FCC, 2007b).¹⁷

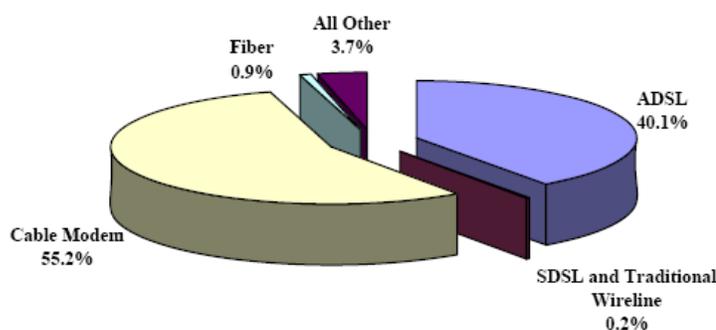


Figure 2-1: Residential advanced services lines by technology as of June 30, 2006 (FCC, 2007b)

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). Although only cable modem and DSL have dominated the U.S. residential broadband market, the FCC has encouraged broadband deployment across multiple platforms based on different technologies as follows (Table 2-2). In particular, WiMax and fiber optic access technologies have the greatest potential in the future.

¹⁷ SDSL and traditional wireline have been decreasing from 0.5% in 2005 to 0.2% in 2006.

Table 2-2: Various broadband technologies, summary

	Speed Mbps	Range	Notes
Wired			
ADSL (G. dmt)	8	Medium	Guaranteed bandwidth, uses splitter, 800kbps upstream
ADSL (G. lite)	1.5	Medium	Longer distances, slower
SHDSL	4.6	Medium	Symmetric, fast
ADSL2	8	Medium	No split, improved ADSL
ADSL2plus	16	Medium	Increased bandwidth of ADSL2
VDSL	52	Short	High speed, short distances
Cable	30	Long	Fast, shares capacity among users
Fiber	10000	Long	Very high speed, optical
Satellite	6-33	Long	Suitable for a location with poor or nonexistent terrestrial infrastructure, latency, line of sight issues
Power line	45*	Long	Interference problem
Wireless			
802.11b (Wi-Fi)	11	100m	Most popular and widespread
802.11a	54	50m	Newer, faster, higher frequency
802.11g	54	100m	Fast, backwards compatible with Wi-Fi
802.11e	54	NA	Adds QoS not present in a, b, g.
802.16 (WiMax)	70	50km	QoS, very long distance, Metro net
Radio LAN	10	35m	Specializes in wireless bridges
HomeRF	1	50m	Replaced by HomeRF2
HomeRF2	10	100m	QoS, better encryption, not widespread
HiperLAN2	54	150m	European standard, QoS, for voice/video
HiperMAN	NA	50km	European, compatible with 802.16a
Bluetooth	1	10m	Personal area network (not WLAN)
Infrared LAN	4	20m	Same room only

Source) ITU (2003); Tongia (2004); <http://www.qrpi.org/~k3ng/bpl.html>

* Raw throughput (typically asymmetrically—27 Mbps downstream and 18 Mbps upstream). This connectivity is shared by all the users in that segment of the network (Tongia, 2004).

Among alternatives to cable modem and DSL broadband service, industry representatives and policymakers see wireless broadband as having great potential for delivery of broadband services, especially since wireless services are far easier to deploy in remote and rural areas, which often lack the necessary wired infrastructure (Hausman, 2002). Representative examples of initiatives come from municipalities' trials to deploy

their own Wi-Fi networks in the community (Woolley, 2005, July 4). As previously discussed, in a response to the delayed and annoying services of the incumbent providers, several hundred small towns and cities have started launching their own *mesh networks* by using Wi-Fi airwaves (Wolley, 2005, July 4).

Deployment of wireless broadband, however, at least currently, lags significantly behind the rollout of cable modem and DSL. Furthermore, the incumbent providers have actively incorporated wireless technologies into their services either as a complementary or as an independent service. On the other hand, the ILECs have started their own initiatives of deploying fiber networks for incorporating video into the package of voice and data (Wilson, 2006, Feb.6). Representative examples are Verizon's *FiOS* fiber-to-the-premises network and AT&T's project *Lightspeed* fiber-to-the-node buildout plans, which are mostly deployed in crowded big cities.

2.1.2 South Korea

Broadband Internet services were launched in Korea in July 1998 by the cable provider Thrunet based on cable modem technology. A year later in April 1999, Hanaro Telecom entered the broadband market as well by offering the world's first ADSL service. In the first place, Hanaro started as a competitive fixed line telephony provider¹⁸ but ran into several obstacles in extending its market share against the incumbent, KT. There was no number portability at the time and users had to face a great switching cost

¹⁸ Hanaro Telecom was selected as S. Korea's second local telephone service provider by Ministry of Information and Communication for the first time in the telecommunications market in 1997 (see http://www.hanaro.com/eng/company/com_history.asp).

when changed to another provider. Users going back to KT from Hanaro were forced to pay large reconnection fees. Facing the fixed line problems, Hanaro changed its strategy from a focus on fixed-line telephony to broadband. This strategic change was particularly successful given KT's reluctance to deploy ADSL due to its high investment in ISDN then. However, when the success of the ADSL service became apparent, KT quickly responded and began offering its own service in June 1999 (ITU, 2005b).

By 2005, the broadband networks in Korea were extensive, and most households had access to two or more technologies to subscribe to broadband. ADSL is available to 90 percent of homes, with cable television networks passing around 60 percent of households. In addition to these core technologies, Koreans often also have access to apartment LAN technology (essentially Ethernet wiring in the building connected to the ISP via fiber), wireless local loop, and satellite connections — each of which have extensive coverage. Currently VDSL speeds of 20-40 Mbps are available to many Koreans at just under U.S. \$50 a month with average speeds in the country at 4 Mbps. However, the Government plans on having 20 Mbps connections available to all homes by 2006 (Lau, Kim and Atkin, 2005).

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 Korea Telecom (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 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 tariff 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).¹⁹

Lau, Kim, and Atkin (2005) found that, drawing from the industrial organization paradigm, the South Korean market is a government-sponsored oligopoly, given the state

¹⁹ Yan, X., & Thong, J. (2003). Tariff-quality equilibrium and its implications for telecommunication regulation. *Telecommunications Policy*, 27, 301–315.

support for major investment in the broadband area. The number of ISPs in South Korea grew nearly four-fold for three years, from 26 in early 1999 to 99 by December 2001 and to 102 by February 2002 while the U.S. shows less than two-fold increase during the same time period. The number, however, was diminished to 81 by October 2002 as a result of mergers and acquisitions with large ISPs, changes in the Internet business, and the demise of PC communication service. This number is expected to continue to decline as the industry reaches a more sustainable equilibrium (KISDI estimate, cited in Lau, Kim, and Atkin, 2005).

The Ministry of Information and Communication (MIC) in South Korea reports that by the end of August 2005 KT held a 51.8 percent market share as a leader followed by Hanaro 23.1 percent, Thrunet 7.8 percent, Onse Telecomm 3.1 percent, Dacom 2.1 percent and Dreamline 1.1 percent. Other value-added service providers (Mostly resellers and cable system operators) held 10.9 percent (Table 2-3). As indicated by market shares, only three major broadband service operators emerged in the market. Furthermore, the difference between the first place and the second place company is great. KT holds almost twice the market share of the next two providers, Hanaro and Thrunet, combined. Lau, Kim and Atkin (2005) ascribe this disparity to the fact that technological innovations have made telecommunications companies increasingly knowledge- and capital-intensive, thus placing them beyond the financial reach of smaller, resource-poor companies.

Table 2-3: Broadband Internet market shares in South Korea (%)

Providers	1999	2000	2001	2002	2003	2004	Aug. 2005
Korea Telecom	5.1	43.9	49.7	47.3	50.0	51.0	51.8

Hanaro Telecom	33.3	28.0	26.4	27.6	24.4	23.1	23.1
Thrunet	56.2	19.3	16.8	12.5	11.6	10.8	7.8
Onse Telecom	-	1.8	2.7	4.3	3.8	3.3	3.1
Dreamline	5.3	3.9	2.3	1.6	1.3	1.1	1.1
Dacom	-	2.3	1.6	1.4	1.8	1.7	2.1
Others	-	-	-	5.2	7.1	9.0	10.9

Source) MIC

Interestingly, intermodal competition in Korea is different from many other economies because a single carrier may offer broadband service over a wide range of technologies. Hanaro, for example, offers broadband over five different technologies: xDSL, cable modem, apartment LAN, LMDS (B-WLL) and wireless LAN (Figure 2-2). The incumbent KT also offers access over 5 different technologies: xDSL, apartment LAN, wireless LAN, satellite and WiBro (ITU, 2005b).

First, the competitive market is mature with extensive networks over many technologies. Second, open access on broadband networks allows any carrier to provide service over other types of networks. A carrier such as Hanaro has open access to KT's unbundled loop as well as Thrunet's extensive cable network. This allows Hanaro to provide service nationwide and over multiple technologies, even if it does not have a physical network presence in the area. Intermodal competition in Korea is fierce and users have many choices available to them. While xDSL and cable technologies make up the brunt of connections, wireless technologies will have a much more pronounced roll in the future. KT's Nespot (WLAN) service has built an extensive Wi-Fi access network around the country and continues to grow. Also, new wireless data technologies are in the planning phase that should allow seamless data connectivity and movement throughout

the country which is called WiBro (wireless broadband).²⁰ The Korean market competition based on multiple platforms will be addressed further in Chapter 4.

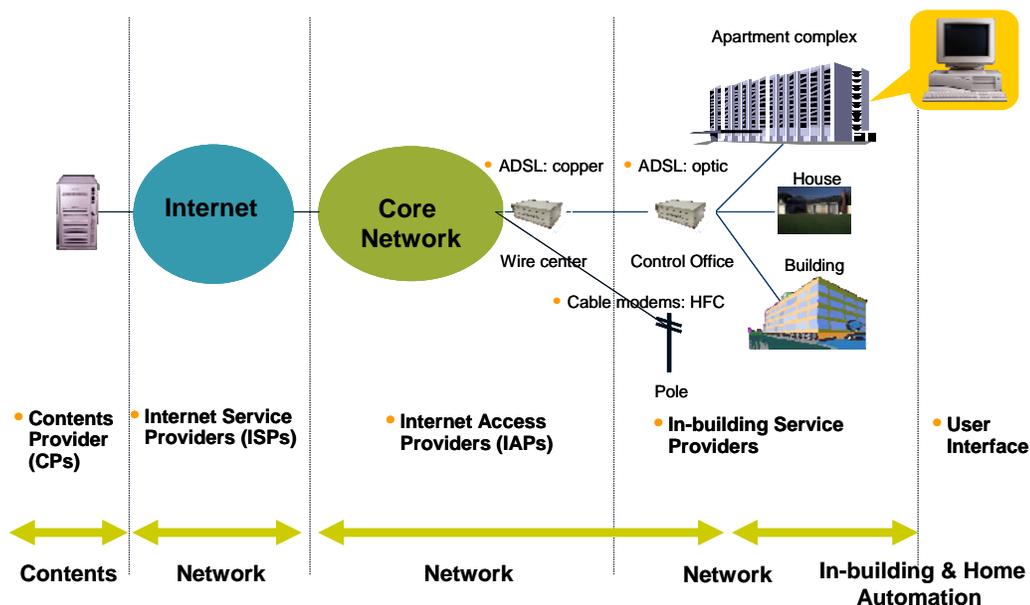


Figure 2-2: Broadband service, interwoven by various networks and functions
Source) NCA (2006)

2.2 Comparison: Commonalities and Dissimilarities

Since the broadband success of South Korea has become publicly known, comparative studies using the U.S. and South Korea as cases have abounded. Most of this literature provides a rich source of information about the recent market structure of the U.S. and South Korea and, at the same time, clarify commonalities and dissimilarities between the two countries. Han, Byun and Lee (2005) inquired why broadband is more readily available in South Korea than in the U.S. and applied the TPC model – a

²⁰ Wireless Broadband (WiBro) service refers to portable Internet service which provides Internet connectivity anytime anywhere even when a user is on the move not to mention at standstill (MIC, 2003).

triangulation of technology/business, policy/regulation and consumers – to examine the differences of both countries in terms of broadband market and convergence phenomena. According to their findings, there are more similarities than differences between the two countries in terms of broadband technologies. However, while ILECs in the U.S. are aggressively moving into FTTP (Fiber-to-the-Premises) deployment, and cable modem dominates, South Korea has more popular DSL services than cable modem service, and is more dynamic in the area of wireless than in landline.

Also, they identified three factors which explain the faster diffusion of the residential broadband access service. (1) the government's culturally sensitive ICT policy, (2) the world class manufacturing capabilities in electronics, and (3) the Korean people's unique cultural traits, including the sophisticated and rushed consumer behavior, the collective culture reflected in the combination of a sort of Internet café, namely 'PC Bang' and online gaming, the sanctity of education, the densely populated living conditions, and the emerging dynamism in Korea.

Lee and Chan-Olmsted (2004) also scrutinized what factors have contributed to South Korea's competitive broadband environment. By applying Porter's competitive advantage model, this study compared the broadband-related environmental factors in the U.S. and South Korea in terms of government, consumer/demand conditions, related and supporting industries, and competition conditions. Thus, the authors tried to answer what were the differences and similarities between broadband Internet development and which factors contributed to the differential development of the broadband Internet in South Korea and the U.S. The finding is that the two nations' differences in broadband status

can be explained by a combination of policy, consumer demands, and supporting/related technologies issues. Also, the authors conclude that facility-based competition seems to work better than simple local loop unbundling in inducing competition in South Korea. Thus, it suggests 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.

Lee, O'Keefe and Yun (2003) apply an innovation model developed by King, et al. (1994) to explain the expansion of broadband and to discuss the actions taken by public and private sectors to help diffusion. By dividing each sector into supply and demand and including social and cultural environmental factors, the study elaborates each factor based on large amounts of secondary data such as media articles, government statistics, reports from international organizations, and findings by commercial organizations. In addition, the authors conducted interviews with four representative experts in the area, e.g., government, telecom industry and research institute. The authors argued that the collision of a supply-side factor (infrastructure competition) with a demand-side factor (high demand mainly due to gaming) and the social/cultural environment led to rapid diffusion. First of all, the authors found that the government was successful in generating high demand through promotions and subsidies targeting 'housewives' (defined as married female not in employment). Because a housewife has actual purchasing power in running a household, the government's policy was considered

a success. Thus, they conclude the most important factor for success is to stimulate demand.

Lee (2002) provides an overall picture of the broadband marketplace and policies as well as Korea's experience, including success factors for rapid growth. He explains the factors as a "harmony of market competition and broadband policy" by concluding that facilities-based competition coupled with deregulation on entry and pricing, industry promotion, encouragement programs by the government, the demand for entertainment and network games, and the unique urban geography has spurred market growth. In addition, he indicates that a major focus of the government's comprehensive plan for the information infrastructure has shifted from industry promotion to bridging the Digital Divide and creating an R&D environment for the development of new technologies.

An (2002) examines three main causes for the successful DSL deployment: Supply, demand, and a comprehensive national broadband policy. The results led to the conclusion that the unbundling of the local loop in combination with the unique conditions of the Korean market environment help explain the high broadband penetration rate. Therefore, this study finally recommends to the U.S. adopting a comprehensive e-government policy by liberalizing legal frameworks including copyright, trademarks and patent. Especially, the author argues that DSL deployment should be considered as part of a broader process of developing an e-centric government policy.

Lau, Kim and Atkin (2005) examine the economic and public policy factors that have contributed to South Korea's global leadership in broadband adoption. In particular,

the authors explore the economic and public policy factors shaping telecommunication development in South Korea, employing a conceptual framework that explicates a triangular relationship between the government, service providers, and users. Success factors such as pro-growth government policies, fruitful broadband applications, technology, market competition, and a high density, technology-savvy population have been identified. The authors found that, although the incumbents dominate the broadband markets in South Korea as in most other countries, this country is unique in two respects: it is the only market in which competitive local exchange carriers (CLECs) have been able to gain significant ground against an incumbent provider, KT, and it has friendlier regulation for latecomers than for incumbents.

In summary, previous literatures studying the Korean broadband market has ascribed the success to the Korean government's pro-competition broadband policy, the collaboration between the government and the industry, and socio-cultural uniqueness of the Korean market. The government's success both in lowering entry barriers to broadband market and in stimulating consumer demands are primary factors among others, which seemingly lack in the U.S. market. Accordingly, this thesis focuses more on a government's role in reducing barriers to entry to introduce competition in the broadband access market. The next section examines the unique features of the telecommunications market and how these features are relevant to broadband access services as dealing with barriers to entry in the telecommunications infrastructures, entry determinants in the local telecommunications market and incumbent companies' entry-

deterrence strategies. The literatures provide a fundamental understanding of entry barriers in the broadband access market.

2.3 Telecommunications Infrastructure and Barriers to Entry

2.3.1 Barriers to entry in the telecommunications market

Telecommunications networks are characterized by high threshold levels of investment, which results in substantial sunk costs, a high fixed to variable cost ratio, significant economies of scale and scope, and externalities (Miller, 1995; Brock, 1981). As indicated in previous economics research further detailed in Chapter 3, 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 George J. Stigler's definition (of barriers to entry that excludes economies of scale as a barrier)²¹ 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

²¹ For a detailed discussion of debates over the definition of entry barriers, please see Chapter 3.

additional barrier to entry because the fixed costs are also sunk once the facilities are built.²² 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 instance, scale economy is a critical barrier when production involves substantial sunk costs. Strategy and structure may interact to create barriers and to sustain profitable operations by incumbents. Nahata & Olson (1989) empirically introduced a situation in which scale economies can act as a barrier to entry. Within the context of the Cournot model²³ with scale economies, industry cost and demand conditions allow a critical number of incumbent firms, such that a new firm would have 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

²² 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 under price their potential rivals (Baumol, Panzar & Willig, 1982; cited in Gabel, p.3).

²³ Cournot model is an economic model used to describe a duopoly market. It has implications as follows: Output is greater with Cournot duopoly than monopoly, but lower than perfect competition, price is lower with Cournot duopoly than monopoly, but not as low as with perfect competition, the firms have an incentive to form a cartel. However, cartels are usually illegal. So, firms have some motive to tacitly collude using self-imposing strategies to reduce output, which, ceteris paribus, raises price and thus increases profits (See http://en.wikipedia.org/wiki/Cournot_model).

cost elasticity 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 Stiglerian sense of the term, scale economies provide incumbent firms with supra-normal profits and prevent the entry of an additional firm. The current residential broadband market in the U.S. seems to bear a striking similarity to this situation.

In particular, telecommunications networks have been distinguished from other manufacturing industry 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 Enterprises (SMEs) (Blees, et al., 2003) analyzed the relevant literature, and found that incumbents are the most powerful party where the height of entry barriers is concerned. This report argues that while incumbents can control most influential barriers in various ways,—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, and by increasing excess capacity, etc.—entrants may lower only one barrier, namely a 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. In sum, economies of scale and scope, and sunk costs have significant meaning in the entry to broadband access market. However, government is able to affect more either elimination or reduction of entry barriers than new entrants do, and its role will be further significant in the broadband access market.

2.3.2 Determinants of market entry in local telecommunications markets

Previous literature in telecommunications has mostly discussed the determinants of market entry into local telecommunications markets which were the primary interest of the Telecommunications Act of 1996, and there is little literature that deals only with the barriers to entry 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 would drive the entry decision: post-entry profitability and entry costs. Firms will enter a market only if they expect to make positive post-entry profits. The authors identified that market size, the intensity of price competition, the level of product differentiation and the existence of rival networks would determine the post-entry profit of a new entrant. The factors that influence the post-entry profit, therefore, determine new entry. A government report confirms the same determinants by an empirical study (GAO, 2006). According to the report, the degree of existing broadband competition in a local market can inhibit or encourage deployment, depending on the circumstances. Some new entrants will avoid entering markets with several existing providers and seek out markets where incumbent telephone and cable companies do not provide broadband service.

Other econometric models and empirical evidence also support this view. First, market size is related to new entry of CLECs²⁴ (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 U.S. 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

²⁴ CLECs (Competitive Local Exchange Carriers) indicate telecommunications providers that compete with incumbent local exchange carriers (ILECs). CLECs include traditional long distance companies, such as AT&T (acquired by SBC in 2005) and MCI (acquired by Verizon in 2006) and other telecommunications competitors targeting mass market customers such as Allegiance Telecom and CTC Communications.

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 entrants: 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 in smaller regions than the existing companies do.

Third, providing residential telecommunications services would require firms to incur substantial upfront investments in physical plant and advertising, a great deal of which will be irrecoverable if exit is required. The irrecoverable costs are called sunk costs. As examined in the previous section, sunk costs are particularly important when new entrants decide to enter the residential telecommunications business that requires considerable investments to construct local distribution networks and advertisement. Xiao and Orazem (2005) recently examined market structure and competitive conduct in local markets for the high speed Internet service from 1999 to 2003. They found unexpected 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.

Fourth, regulation and competition policy will greatly influence the decision for 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.

2.3.3 Incumbents' strategies for deterring new entry

Several studies have also examined the pre- and post-entry strategies of an incumbent in the U.S. local exchange markets. Discussions of pre-entry deterrence by a market incumbent 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 RBOCs'²⁵ local residential telephone services and found that entry did not significantly influence the local residential rates of RBOCs. Also, after entry occurred, the ILECs were more likely to respond with aggressive advertising and withdrawal of diversification rather than an aggressive pricing (Koski & Majumdar, 2002). 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

²⁵ Regional Bell Operating Companies

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. This is an interesting finding because the ILECs have argued that the entrance of CELCs based on the UNE rules had lessened their incentive to invest in the network systems.

Chapter 3 Theoretical and Methodological Approaches

3.1 Theoretical Approach

3.1.1 Historical debates on the definition of entry barriers

Entry barriers do not have any coherent and widely-accepted definition. Indeed, there are few economic terms that have caused 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).²⁶ Also, it can be viewed from the perspective of the entering firm and from the perspective of incumbent firms. Historically various viewpoints have differentiated themselves 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 3-1).

²⁶ 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 an 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).

Table 3-1: 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. -Incumbents' unnecessarily high profits without entry	-Accepting Bain's and Ferguson's definition. -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)

3.1.2 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 barrier-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 effects 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 barrier-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). Stigler suggested that many practices previously thought harmful to competition in fact reflected healthy competition. He defined entry barriers as the additional long-run costs that must be incurred by an entrant relative to the long-run costs faced by incumbent firms. This definition might include the possibility, of great concern to Chicago school antitrust commentators, that entry would

be prevented by regulation, patents, tariffs or other government action. But if incumbents obtained an advantage over entrants by being first to make expenditures that entrants would need to replicate in order to compete, or if the market could not support multiple firms at the scale needed to achieve low costs, those advantages should merely be seen as an appropriate reward that competition provides to the incumbent, who had the foresight or luck to enter first (Baker, 2002).

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 3-2).

Table 3-2: 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 barriers to entry</i>	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

In theoretical perspective, Stigler's definition is more sophisticated than Bain's. Thus, it has been widely accepted as 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 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 competitive level. For the purposes of this paper, 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 3-2).

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 to avoid unnecessary controversy.

A standalone barrier to entry is a cost that constitutes a barrier to entry by itself, for instance, 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 3-3). Thus, these definitions are more comprehensive and precise as they embrace various definitions discussed in the previous literature.

Table 3-3: 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 a dissenting note, Carlton (2005) points out that Bain's conception of entry barriers is based on an incorrect theoretical assumption 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. This thesis incorporates 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 & 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 & White, 1994) has been described as having a unique 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.

Although the empirical evidence of the presence of barriers to entry has been suggested in many different disciplines, it has been segmented by each entry barrier and measured mostly by survey methods.²⁷ Since this thesis conducts a case study with the intention of investigating the overall presence of barriers to entry in the broadband access market rather than of empirically demonstrating the presence of each barrier, a general evaluative framework was adopted. The next section, therefore, introduces the analytical framework for evaluating the presence of barriers to entry.

3.2 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

²⁷ As for a thorough examination of literature measuring each entry barrier, please refer to Blee, et al. (2003).

report suggesting the best practices to assess barriers to entry in a market and proposing methods of measuring entry barriers (OFT, 1994).

Modifying one Office of Fair Trading research paper's "seven step procedure for assessing entry conditions" to the telecommunications market, Kim and Lee (2005) suggested eight steps for evaluating barriers to entry and conducted a case study about South Korea's retail broadband access market. This thesis adopts the eight evaluation steps and the steps consist of: (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, and (8) entry impediments, such as certification requirements and required time to build up brand name.²⁸ Each step will be examined with essential questions as follows (Figure 3-1).

3.2.1 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. Production substituters are defined as firms that can switch production activity to the relevant market (product or geographical)

²⁸ The following 8 steps are mostly derived from the Office of Fair Trading (1994)'s enumerated discussion about barriers to entry.

speedily and without significant sunk costs, that is, low sunk cost entrants (OFT, 1994, p.25). 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?²⁹ 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.

3.2.2 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?

²⁹ However, this question is not applicable in the telecommunications market because the ownership from outside of the domestic boundary is strictly controlled by the government.

Have market conditions changed recently? If recent market history exhibits substantial entry via investment in new capacity on a large scale, then there is little *a priori* 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. Also, OFT suggests that more investigation be required when entry has been small-scale, short-lived, or merely by acquisition. Since empirically most entry is of this type, 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 considered.

3.2.3 Step 3: Assessment of absolute (cost) advantages

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

3.2.4 Step 4: Sunk cost, economies of scale and capital requirements

Although capital requirements are one of the most important factors to deter entry, the notion of capital requirements as one of barriers to entry lacks theoretical foundation (OFT, 1994). It is well known that new entrants face more difficulties gathering the required capital than it is for existing firms either within or outside the market. The need to invest large financial resources in order to enter a certain market constitutes a large barrier to entry (Bain, 1956; Porter, 1980; Karakaya & Stahl, 1989; cited in Blee, et al., 2003).

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? Are there price increases, output reductions, reestablishment of stable or collusive pricing strategies etc.? How sunk are costs? Is it short-term or long-term? What is the proportion of sunk costs to total costs?

3.2.5 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, 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 falls in a homogeneous and price-sensitive high speed Internet access market.

Ford, et al. (2005) also suggests that product differentiation between intramodal competitors would be less than that between intermodal competitors, as illustrated by a study of 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.³⁰

Some critical questions can be framed 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 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.?

3.2.6 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

³⁰ DBS providers reduced cable prices by about 5%, whereas the terrestrial video rival reduces price by about 16% (GAO, 2005). U.S. 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)

anticompetitive effects. Gabel (2002) finds 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 have to be connected through the physical networks with the premises. In most countries, a monopolist which owns both the last mile³¹ and interconnected networks has been providing the end-to-end service. Plausible questions are as follows: What is the nature of the incumbent's 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?

³¹ The wireline bottleneck facilities linking the public telecommunication networks with virtually every home and business premises nationwide.

3.2.7 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? 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.

3.2.8 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 supra-normal profits for the incumbent, but they may be important to antitrust decisions (to allow a merger for example) because they influence the amount of time for which 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.

	Subjects		Specifics
Step 1	Defining market	⇒	The presence of relevant markets and production substitutes
2	Market conditions, historical entry	⇒	<ul style="list-style-type: none"> -The profitability of firms -Time required for a new entry -Change of market competitiveness
3	Absolute cost advantages	⇒	<ul style="list-style-type: none"> -Cost asymmetries b/w incumbents and new entrants -Most legal and regulatory barriers
4	Sunk costs, economies of scale, capital requirements	⇒	<ul style="list-style-type: none"> -Substantial sunk costs -The intensity of expected post-entry competition
5	Product differentiation, advertising, switching costs, network externalities	⇒	<ul style="list-style-type: none"> -The level of Product differentiation -The importance of advertising -The presence of switching costs -Strategies to create consumer loyalty
6	Vertical foreclosure, vertical exclusion	⇒	<ul style="list-style-type: none"> -Exclusive dealing and contracting -Exclusive territories and franchising, -Exclusive/long term contracts w/ customers -Refusal to supply -Product tying and bundling
7	Predatory behaviors	⇒	<ul style="list-style-type: none"> -Predatory pricing -The market share of the (alleged) predatory firm

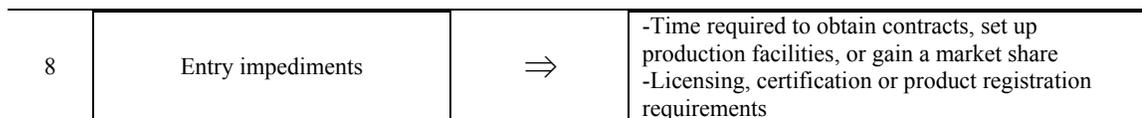


Figure 3-1: Evaluative steps to determine entry conditions

3.3 Methodological Approach

3.3.1 Comparative case study

To answer the research questions, both a comparative case study and an empirical analysis based upon government documents and industry data will be adopted. A research design proposing a comparison between cases often has special appeal. In a certain sense all research is comparative because it must use, implicitly or explicitly, some point of reference. Making the comparison explicit raises its value as scientific inquiry.

First of all, a case study can be defined as an empirical inquiry that uses multiple sources of evidence to investigate a contemporary phenomenon within its real-life context, in which the boundaries between the phenomenon and its context are not clearly evident (Yin, 1994). Comparative case study research, frequently used in political science, is an example of the multiple case study technique. Since this approach is particularistic, descriptive, heuristic and inductive (Merriam, 1998), it is a good method for studying practical, real-life problems and helps people to understand what's being studied. Also, it may suggest new interpretations, new perspectives, new meanings and fresh insights by employing as much evidence as possible (Merriam, 1998). Documents, historical artifacts, systemic interviews, direct observations and even traditional surveys

can all be incorporated into a case study. Thus, a case study uses as many data sources as possible to systematically investigate individuals, groups, organizations or events.

First, there is no unified definition or index to looking at barriers to entry in an industry. Second, this thesis needs to incorporate a diverse set of factors into the analytical framework reflecting unique characteristics of the broadband industry. Therefore, the research questions of this thesis are more likely to be properly answered through a case study. The data sources will include, but are not limited to, government documents, law reviews, statistical reports, news reports, scholarly theoretical works, commercial reports etc. A relatively exhaustive review of literature dealing with broadband access market and barriers-to-entry relevant topics will be conducted as well as a thorough review of trade publications in the relevant market segments. Because of many weaknesses in the literature (in scope, in numerous gaps, and in theory building), it is hoped this thesis can make a major contribution in defining the terrain of this complex and difficult area so that more rapid and coherent progress can be made.

3.3.2 Empirical investigation

A framework of barriers to entry analysis adopts an empirical element into the analysis by calculating the number of entrants over time by using secondary data sets derived from the FCC statistical reports and South Korea MIC data (See below table). In addition, the presence and perceived importance of barriers to entry in the U.S. context was examined by conducting an industry survey including complementary interviews with company executives. A factor analysis and an independent sample t-test were

performed to find the underlying dimensions of barriers to entry evaluated by company executives who make entry decisions. The research will be covered in Chapter 5.

Comparison of barriers to entry by platforms in the U.S. and South Korea

		The U.S.			South Korea		
		Barriers to Entry	No. of Entrants	Growth Rates	Barriers to Entry	No. of Entrants	Growth Rates
Entrance with Facilities	BPL Wireless Satellite	-Regulation -Economies of scale -Sunk cost -Product differentiation	1999-2004			1999-2004	
Entrance without facilities	DSL Cable Modem						

Chapter 4 Analysis: The Broadband Market and Barriers to Entry

4.1 Market Definition and Production Substituters

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.³² 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).³³ Thus, the broadband market will be defined as a high-speed Internet service market with a rather moderate speed defined by the FCC. Under that definition, every kind of access service currently available must be included in the range of broadband service even though the speed is often not enough for VoIP and video that require much higher bandwidth.³⁴ Despite quality and speed differences among many different technologies, they have been considered as substitutable in general.

On the other hand, the geographic market for residential broadband in the U.S.

³² 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).

³³ While this thesis was writing, the FCC produced a Notice of Inquiry (NOI) seeking comment on the need to alter the definitions of high-speed Internet with changes of technology and marketplace. In the past, the Commission has used the term “high-speed” to describe services and facilities with more than 200 kbps capability in at least one direction (FCC, 2007, April 16).

³⁴ 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).

should be defined within a certain local residential area. The FCC has collected the number of providers on a zip-code basis and on a state level. Since the FCC does not distinguish between the residential market and the business market in the data, it seems hard to find how many substitutors exist in a certain residential area. Only survey based on a certain local residential area will reveal this kind of information.

Instead, the FCC reports the information based on a zip code basis. The FCC data shows that 99% of Zip codes were listed by at least one provider. ADSL and/or cable modem connections were reported to be present in 88% of Zip Codes. In 57.8% of ZIP codes, both ADSL and cable modem subscribers have been reported. 24.2% of ZIP codes reported ADSL subscribers but no cable modem subscribers whereas 5.9% of ZIP codes have cable modem subscribers but no ADSL subscribers (FCC, 2007a). This report indicates that almost ubiquitous broadband access services are available to customers and more zip codes with ADSL subscribers exist than those with cable modem. From the report, it is estimated that copper wire based ADSL has been available in a wider area than cable modems although the number of cable modem subscribers is greater than that of DSL subscribers.

In South Korea, the relevant market for residential broadband service refers to an Internet access service of which the download speed is more than 1 Mbps (MIC, 2002).³⁵ This includes DSL, cable modem, B-WLL,³⁶ Ethernet LAN, satellite Internet and so on.

³⁵ The Korean government recently increased the fundamental speed of broadband access from 1 Mbps to 10 Mbps (NIDA, 2006).

³⁶ Broadband-Wireless Local Loop. This is the same technology as local multi-point distribution service (LMDS) in the U.S. B-WLL providers build up a wireless antenna in front of a building or an apartment complex and, from that

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 (Kim & Lee, 2005). 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.

4.2 Market Conditions and Historical Entry

4.2.1 The U.S.

As previously mentioned in Chapter 2, the U.S., the residential broadband market has been dominated by cable systems and incumbent telephone companies (GAO, 2006). Furthermore, the enterprise market for broadband services seems not much different. Broadband ISPs claim that the enterprise market has no competition at all, allowing Verizon, AT&T and other incumbents to set the market price (Mark, 2007, March 19).

The FCC data also confirms the dominance in both residential and commercial markets. While new entrants, based upon wireless, satellite and BPL technologies, have been gradually increasing, aggressive marketing by telephone companies and the rather stable dominance of cable companies have still left them behind, in particular, in terms of market share. While the market share of coaxial cable access from 1999 to 2004 slightly

point to individual unit or household, transmit a variety of multimedia services, e.g., high-speed Internet, videophone, video-on-demand, even local telephone services.

increased from 51.3% to 56.4%, ADSL share increased from 13.4% to 36.5% during the same period of time. In contrast, other wireline technologies including symmetric DSL and fiber, wireless and power line have been rapidly decreasing (from 22.1% to 3.9% and from 11.3% to 1.8%, respectively). ILECs still represented about 96% of facilities-based ADSL high-speed lines in service as of Dec. 31, 2004.³⁷ When all technologies are considered, ILECs provide about 38% of high-speed connections to end users (FCC, 2005, July).³⁸

ILECs have started aggressive pricing and introduced broadband services differentiated by 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). In the first quarter of 2006, the average price for broadband service was \$39.45 a month from the five top cable operators and 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 January 2007 report of the FCC, the number of high-speed Internet service providers significantly increased from 105 providers in 1999 to 552 providers in

³⁷ Until June 30, 2006, ILECs or their affiliates reported 96.7% of ADSL connections (FCC, 2007, January).

³⁸ As previously indicated, the FCC reports show that DSL and cable modem are still leading the market whereas other access technologies have held a scanty of market shares (FCC, 2007, January). Of the 45.9 million lines designed to serve residential end users, cable modem represented 59.9% while 35.8% were ADSL, 0.2% were SDSL or traditional wireline, 1.0% were fiber to the end user premises, and 3.2% used other technologies which include satellite, terrestrial fixed wireless (licensed or unlicensed), terrestrial mobile wireless (licensed or unlicensed) and electric power line. In addition, 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 (Rosenbluth, 2006, August 24).

2004 (Table 4-1). Since the FCC did not include smaller providers with less than 250 lines until Dec. 2004, only the growth rates from 1999 to 2004 were comparable. During that time period, it was apparent that there was an overall growth of the number of providers across all the access technologies but new entrants tended to enter the market more with ADSL or other access technologies (SDSL, traditional wireline, fiber, satellite, fixed and mobile wireless, and power line) than with cable modems. If providers with less than 250 lines are included, the number of providers amounts to 1,323 in June, 2006. ADSL providers have led the major growth by recording a more than eleven times increase in numbers since 1999. Including small companies with less than 250 lines after Dec. 2004,³⁹ the number of ADSL providers increased from 352 to 758, the number of cable modem providers from 147 to 227, and the number of all other providers from 312 to 779 (Table 4-1). The increased portions of providers indicate that there are many smaller providers with less than 250 lines in the market and again, most of those providers have used ADSL or other access technologies rather than cable modems. This may point out that, since cable has preserved a closed network system, it may be easier for small companies to get access to ADSL lines from the incumbents or other alternative technologies. Figure 4-1 better portrays the growth rates of each category. When the line drops at a point, it means that the growth rate of new entrance decreased compared to previous year at that time, for instance, the lowest entrance rate of ADSL was in June 2004. Interestingly, the number of “all other” providers decreased since December 2005 and the total number of providers did also.

³⁹ Many of those small providers serve rural areas with relatively small populations and they were underrepresented until the previous Dec. 2004 data (FCC, 2007, January).

Unfortunately, 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. Moreover, the FCC did not distinguish providers with all other technologies until June, 2005. We cannot tell how many new entrants entered the residential market using which technologies during the time of period.

Table 4-1: 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	758	115%	227	54%	779	150%	1270	130%
Dec 2005	820	8%	242	7%	835	7%	1347	6%
June 2006	832	1%	253	5%	814	-3%	1323	-2%
Dec. '99- Dec. '04		1157%		242%		380%		426%

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.

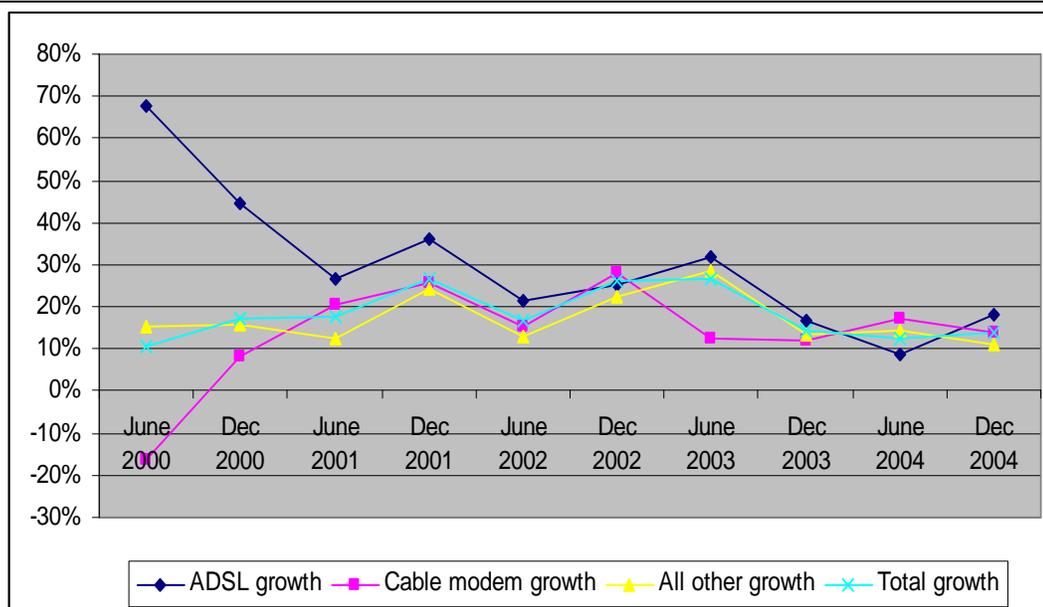


Figure 4-1: The growth rate of providers of high-speed lines by technology (The U.S.) (1999-2004)

Therefore, the FCC data with more specified access technologies (Table 4-2) show a more detailed current market situation. During one year (June 2005-June 2006), the number of SDSL, satellite and power line providers decreased overall but power line decreased more rapidly since Dec. 2005. In contrast, fiber and mobile wireless increased more than ADSL and cable modem. This table also shows that, of a total of 1,323 unduplicated providers, at least 70% have utilized multiple access technologies for their provision of broadband services, although the number does not distinguish the residential from the business uses. This is consistent with the survey results of Chapter 5 in that most providers have employed multiple access technologies, for instance, one provider with ADSL, wireless and dial-up through traditional wireline.

Table 4-2: Providers of high-speed lines by technology (June 2005-June 2006) (Over 200 kbps in at least one direction)

	ADSL	SDSL	Traditional Wireline	Cable Modem	Fiber	Satellite	Fixed Wireless	Mobile Wireless	Power Line and Other	Total (Unduplicated)
Jun-05	758	270	206	227	138	6	423	13	18	1270
Dec-05	818	268	237	240	169	5	459	16	17	1344
Jun-06	832	257	246	253	185	5	450	19	6	1323
Increase	74	-13	40	26	47	-1	27	6	-12	53
Growth Rate	9.8%	-4.8%	19.4%	11.5%	34.1%	-16.7%	6.4%	46.2%	-66.7%	4.2%

Source) FCC (2007a)

4.2.1.1 xDSL

If a new entrant plans to provide any kind of DSL service in the residential market, the first critical issue they have to handle is to get access to the last mile networks of incumbent telephone companies. xDSL technologies include the most popular ADSL, convert pairs of copper wire telephone lines into high-speed digital lines. Therefore, the emergence of Internet services draws attention to the importance of access to the local loop since ISPs have to depend on local network providers to access customers.⁴⁰ If an incumbent company refuses to deal with essential facilities such as the broadband local loop for DSL service, the access to these facilities (resources) can be not only a barrier to entry to entrants but also a source of competitive advantage to incumbents.

Historically incumbent telephone companies were considered as public utilities during the monopoly era in most countries. New entrants usually could not replicate the incumbents' local networks because of many difficulties such as access to rights of way, the costs of network construction relative to revenue growth, and the difficulty of enticing

⁴⁰ 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).

residential customers to change access and service providers (OECD, 2002). To overcome those difficulties, many countries have adopted local loop unbundling (LLU), a policy that mandates the incumbent carriers lease, wholly or in part, the local segment of their telecommunications network to competitors (OECD, 2002). Because these unbundled local loops could be used by new entrants to offer voice and data services, for instance xDSL services, the unbundling has been a critical issue in the residential broadband access market.

Aligning with the world wide adoption of the unbundling rule, the Telecommunications Act of 1996 in the U.S. has also required ILECs to make their network services and facilities available to competitive local exchange carriers (CLECs). In doing so, the Act enabled CLECs to serve customers without building their own facilities, either by reselling ILEC services in their entirety or by employing components of ILEC networks, called unbundled network elements (UNEs). Under resale, a CLEC purchases at a wholesale discount the retail services supplied by an ILEC, and then re-sells these services to its retail customers using its own brand name. Under the UNE approach, a CLEC leases components of an ILEC's physical network (*e.g.*, a loop and/or a switch) in order to deliver retail service to customers. CLECs may lease all of the UNEs needed to deliver a service (*i.e.*, use the UNEs as a platform for delivering services; referred to as the UNE-Platform, or UNE-P). Alternatively, a CLEC may lease only selected UNEs, and combine these UNEs with its own facilities. Under this approach, a CLEC often combines its own switches with leased ILEC loops to deliver switched

access service to customers. This approach is referred to as UNE-Loop, or UNE-L (Wood, et al., 2004).

Another important rule directly related to broadband access providers was the ILEC line sharing rule. Line sharing enabled a CLEC company to offer DSL over the same single, home-phone line that the phone company uses to provide voice service. A separate splitter divides the loop into a voice line leading into a circuit switch and a data line leading into a packet-switched network. Under the line sharing rule ordered by the FCC in 1999, a CLEC could provide DSL while an ILEC provides voice service over a single copper loop (Nuechterlein & Weiser, 2005)

However, the UNEs and the line sharing have been notoriously contentious taking into consideration incentives given to the incumbents and new entrants. The debate concerned whether new entrants in the wireline telecommunications market (mostly CLECs) should have regulatory entitlements to lease capacity on the broadband-specific network elements owned by ILECs. ILECs argued that the best way to promote broadband competition in the last mile is to free them from any obligation to lease such capacity to their rivals. That is, such unbundling obligations would depress the incentives of ILECs and CLECs alike to invest in costly facilities.⁴¹ CLECs, in contrast, claimed that unless regulators give them expansive rights of access to these wireline broadband

⁴¹ The FCC agrees with ILECs' opinion on the unbundling rules stating in its TRO in 2003, "While unbundling can serve to bring competition to markets faster than it might otherwise develop, we are very aware that excessive network unbundling requirements tend to undermine the incentives of both incumbent LECs and new entrants to invest in new facilities and deploy new technology. The effect of unbundling on investment incentives is particularly critical in the area of broadband deployment, since incumbent LECs are unlikely to make the enormous investment required if their competitors can share in the benefits of these facilities without participating in the risk inherent in such large scale capital investment" (FCC TRO, 2003, para.3). However, interestingly, Ford (2004, May 13) points out that econometric research has shown consistently that the unbundling obligations have actually increased investment by both CLECs and ILECs.

facilities, the mass market for broadband services will indefinitely remain a duopoly shared between ILECs and cable companies (for more thorough discussion, see Ch. 5 in Nuechterlein & Weiser, 2005). After a long battle over this issue, the FCC finally abolished ILEC line sharing obligations in its *Triennial Review Order* (TRO) in 2003 (FCC, 2003). Also, the FCC endorsed the phasing out of UNE-P a year later (FCC, 2004).

When the FCC eliminated the obligations of ILECs to provide competitors the access to the “*High Frequency Portion of the Loop*,” it reasoned that “the fact that broadband service is actually available through another network platform and may potentially be available through additional platforms helps alleviate any concern that competition in the broadband market may be heavily dependent upon unbundled access to the High Frequency Portion of the Loop (HFPL).” (FCC, 2003, at 263). In addition, ILECs, as the FCC reasoned, will be able to invest more fully in building infrastructure if they know they don’t need to share these investments with competitors.

The problem of this reasoning is that the potentially available networks have not been mature enough as like telephone and cable networks and realizing broadband services over alternatives, such as wireless or power line networks, still requires immense amounts of capital. The existing competitors using DSL have faced higher costs and lower profitability. Furthermore, incumbent telephone companies have tried to eliminate the access to unbundled local loops. Recently Verizon has called for eliminating access to these loops in ten states from New Hampshire to North Carolina covering more than 35 million Americans, while Qwest has lobbied to eliminate copper loop access for an additional 12 million Americans (Chin, 2007, June 15).

Any absence of line sharing rights would not itself keep CLECs from providing DSL over an ILEC's copper loops. A CLEC remains entitled to lease the whole loop albeit at the usual TELRIC-based rates. However, the removal of the line sharing rule has limited significantly the ability of new entrants to enter only the residential DSL market because they are likely to face increasing prices of the network elements even though they can still lease the networks. The prices might not match the entrants' retail prices, which may result in higher retail prices, less competitiveness and low profitability in the end since new entrants usually, introduce their services at relatively low prices in order to win over customers.

Reiter (2005), in examining the effects of FCC policy on downstream competition between broadband providers and their competitors, concludes that the FCC's deregulatory decisions have come far from achieving its goal of encouraging the ubiquitous availability of broadband. In addition, there are significant concentration in the broadband delivery market and limitations of intermodal competition between broadband platforms. Also, Reiter suggests that there are scores of examples of ISPs denied access to broadband and many other complaints that access has been extended only on onerous terms and conditions. The impact of those access problems on market competition may be far greater than the appearance. Even "allegations of discrimination are serious because, if nothing else, they represent a perception by market participants that the market is not working fairly. If market participants perceive that other participants have an unfair advantage through their ownership or control of transmission facilities, it can inhibit their willingness to participate in the market, thus thwarting the

development of robust competition” (Regional Transmission Organizations, 2000; as cited in Reiter, 2005, p. 319).

What is worse, most customers are not eager to switch from the incumbent company to an alternative provider because the price difference is small and the risk of losing quality performance is perceived to be quite large (Blees, et al., 2003). Thus, without enough incentives such as substantially lower price and better quality, subscribers will be reluctant to switch their provider. Ultimately, the higher price of leasing networks will make DSL competitors decide either to be out of the market or to deploy their own networks.

According to a nationwide ISP survey conducted a few years ago, over 60% of ISPs offered broadband mostly through CLECs. However, of the 40% of ISPs who did not offer DSL then, the primary reason was predatory pricing or harm caused through anti-competitive behaviors dealing with the installation and ordering issues (New Networks Institute for Teletruth, 2003). As further discussed in Ch. 5, our survey and interview results suggest that the difficulty of getting access at cost still exists and will continue to be present until CLECs need to get access to ILECs’ networks and ILECs hold complete control over the broadband networks.

Consequently, CLECs have tried to diversify their access platforms to overcome those market barriers and minimize access costs. For instance, Covad purchased two wireless providers in 2006 to offer WiMax services with the expectation of circumventing high access charges. The company has been losing traditional landline DSL customers each quarter (Van, 2006, Oct. 11). For existing DSL competitors and new

entrants, eventually, a critical regulatory issue would be how to get access to an ILEC's broadband-enabled pipes to homes and small businesses on a non-discriminatory basis at a marketable rate.

4.2.1.2 Cable modem

While telephone companies had been long required to strip out the underlying transmission function from any Internet access services they sell consumers and sell it on equal terms to unaffiliated ISPs, cable operators have never had such an "open access" obligation to unbundle the transmission component of their broadband Internet access and sell it to unaffiliated ISPs. Instead, they typically offer their customers Internet access through an affiliated ISP (Nuechterlein & Weiser, 2005).

In the late 1990s, the matter of opening a cable network to multiple independent ISPs was fiercely debated.⁴² Bittlingmayer and Hazelett (2002) maintained that a forced open access rule would make cable companies under-invest in their networks and result in less capacity and innovation. Nuechterlein and Weiser (2005) point out a technological feasibility issue in the implementation of open access and the FCC's reluctance to impose open access on cable companies.

The open access rule has been never allowed by the FCC despite the concern of cable companies' presumptive dominance in the broadband transmission market and leveraging their dominance to discriminate against unaffiliated ISP access. Cable

⁴² About the detailed debates, please refer to Bittlingmayer and Hazelett (2002), Nuechterlein & Weiser (Ch.5)(2005), and Reiter (2005).

companies hold the same market structure as ILECs': a closed bottleneck system and a highly concentrated, vertically integrated local monopoly. Furthermore, their rather free regulatory status has brought them completely discretionary control over which technologies and services they provide to customers. Thus, cable operators have had strong bargaining leverage over content providers, services providers and Internet service providers. This situation is reflected in cable prices, which have remained constant or increased (Ferguson, 2004). Even facing the competition from ILECs, cable operators have not responded with price reductions yet (Scott, 2007). Therefore, as for new entrants, access to cable networks cannot be a default option and it may be the reason that the number of entrants have concentrated in ADSL or other access technologies rather than in cable modems when they entered the market as shown in the previous FCC data. The growth rate of broadband providers utilizing cable modem technology was significantly low compared to other services.

4.2.1.3 Wireless residential broadband

Wireless broadband options available to residential users have been limited as a viable third competitor for fundamental technological and economic reasons. First, technologically, the bandwidth and price-performance ratios of wireless service are inferior to those of wireline systems and the service speed deteriorates markedly with distance. As a consequence, wireless systems were not expected to offer broadband services in any way that could provide large-scale competition to ADSL and cable

modem even though their faster rates of technological development have been admitted (Ferguson, 2004).

Second, the spectrum issue has not been solved politically and economically. As the FCC has categorized, wireless broadband can be divided into fixed wireless and mobile wireless. Although mobile wireless services, e.g., Internet access on your cellular phone, has been hyped as another intermodal competitor by the FCC, its technological and economic limitations have made it far removed from being a real third competitor vying for residential broadband users (Scott, 2007). Above all, the service requires licensed spectrum that the FCC has not given away. It would take time before any provider will be able to offer broadband wireless services at very large volumes in the near future. Furthermore, the current allocation method of auctioning spectrum has created an economic barrier to new entrants by preventing the regulators from allocating the spectrum to unique applications such as “open spectrum” initiatives or other wireless packet data applications that allow for shared spectrum.

More recently the FCC decided to auction off the 700 MHz wireless spectrum. Soon after, a group of wireless industry entrepreneurs asked the FCC to secure a portion of the spectrum for open access, which will contribute to innovation from entrepreneurs (Caulfield, B., 2007, June 8). Advocates of open access have been concerned that, if incumbent wireless companies were to win the spectrum auctioned by the government (as in most cases historically), the winners would delay the introduction of new services running on the spectrum while continuing to generate cash flow from existing wireless

networks (Ozanich, et al., 2004).⁴³ Indeed, a consortium of top cable companies and Sprint⁴⁴ won 137 licenses from an auction of the Advanced Wireless Services (AWS) spectrum in 2006 but has not moved rapidly to exploit it. Thus, this was criticized as the cable companies' warehousing strategy that hoards spectrum to blunt competition from possible rivals in providing Internet access (Hearn, 2007, June 18).

Due to a tremendous amount of spectrum cost and capital requirements, mobile wireless services are priced well above DSL and cable modem prices, and are marketed primarily to businesses, not consumers (Nuechterlein & Weiser, 2005; Scott, 2007). In due course, they cannot be a competitor but a complementary service to land-line broadband access.

Wi-Fi⁴⁵

Given the scarcity of the spectrum available for mobile wireless services, Wi-Fi has been regarded as a more reasonable alternative option to new entrants. According to an industrial report (Gibbons & Ruth, 2006), there are low barriers to entry in the Wi-Fi access market compared to other broadband technologies. Relative ease of obtaining equipment, an unlicensed and free Wi-Fi spectrum, and relative availability of technical know-how have combined to create a positive environment for new entrants, e.g., at this

⁴³ In an analysis of the spectrum auction experiences in the western European countries, Ozanich, et al. (2004) found four trends: "(1) 3-G network development and services have been delayed. (2) Payments to governments by the winning bidders have been delayed, and there have been requests to reduce the final bid amounts. (3) Companies are seeking mergers or network sharing agreements in order to reduce costs and decrease the number of competitors. (4) The delayed roll-out of networks is allowing the incumbent licensees to continue to generate revenues from existing 2-G networks (pp.231-232)."

⁴⁴ Cable-operator participants included Comcast, Time Warner Cable, Cox Wireless, and Bright House Networks.

⁴⁵ 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.

time, numerous municipalities' deployment plans.

However, Ferguson (2004) addresses why Wi-Fi cannot provide effective competition to ADSL and cable modems or effective coverage to the majority of the U.S. broadband market. First, Wi-Fi networks depend on the ILECs for "backhaul", transmission between the local-area Wi-Fi network server and the Internet backbone. To provide Internet access, Wi-Fi networks need a local broadband connection. The cost, price and performance of Wi-Fi systems are dominated and limited by ILEC DSL, T1, and T3 services. Second, the short range of Wi-Fi systems requires providers to build up as many antennas as needed, replicating the installation cost every hundred yards. Even with technological development, Wi-Fi services will not be able to provide the sufficiently high speed required by many businesses. In addition, more recent efforts by municipalities to deploy a city-wide Wi-Fi network have faced another difficulty of avoiding signal conflict with the existing Wi-Fi networks. In some geographic areas, congestion in certain unlicensed spectrum bands makes providing wireless broadband Internet access more difficult. Thus, to overcome those weaknesses of Wi-Fi, a more advanced wireless technology, WiMax, has been commercially trialed and experimented among small and large ISPs, and municipalities.

WiMax

WiMAX radio networks have been proposed as an alternative technology to provide services for the fixed broadband access market, currently dominated by DSL and cable modem systems. WiMax has a large range of coverage of up to 70 miles and a high

transmission rate exceeding 100 Mbps (Table 4-3). WiMax differs considerably from Wi-Fi technologies because it is designed to replace the last-mile networks and thus, it is expected to challenge DSL and T1 lines (Abichar, et al., 2006).⁴⁶

Smura (2005) examines the economic feasibility of WiMAX network deployments by using a quantitative techno-economic model. The results of the analysis show that WiMAX network deployments can be profitable in dense urban areas as well as in rural areas where the availability of other alternatives is limited. Low profitability can be expected in urban and suburban areas with medium population densities and good availability of other access network alternatives. The most critical success factors regarding the profitability of WiMAX network deployments are the CPE price and broadband tariff levels. Minimizing the total cost of outdoor CPEs, including the equipment and installation costs, is vital for a profitable business case. Based on the results, the researcher concluded that the performance of the systems appears to be suitable for the broadband traffic demands of today, but the emergence of services requiring higher data rates above 2-4 Mbps per subscriber may turn out to be problematic for WiMAX operators. This result concurs with Ghosh, et al. (2005)'s findings, saying that WiMax's competitiveness may be limited due to the actual data rates and ranges that are achieved because the total data rate has to be divided among all users in the cell.

Although this technology is still embryonic, 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. A group of small or large ISPs

⁴⁶ According to Sprint Nextel, WiMax can deliver four times the amount of data at one-tenth of the cost of their current wireless technology (The Economist, 2006, Aug. 12).

started or have experimented with wireless broadband services based on WiMax technology (FCC, 2005, September 30). For example, Clearwire, TowerStream and Nextel have started trial wireless broadband services since 2004. Intel and Motorola announced a \$900 million investment plan in Clearwire in July, 2006. Covad has acquired DataFlo Communications, a wireless broadband provider in Oct. 2006 in order to eventually offer Wimax wireless broadband service in the Chicago area. Sprint Nextel is going to invest \$3 billion by 2008 to get the network functioning aiming to create a market for linking devices to the Internet that today are not connected yet, for instance, from digital cameras and music-players to sensors and household appliances (The Economist, 2006, Aug. 12).

The problem is that this development has been mostly 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.⁴⁷

New entrants: Municipal Wi-Fi networks

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; see Table 4-3). Historically, some municipalities have already entered communications markets by providing high-speed Internet and video

⁴⁷ 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).

services to their territories through public utilities or contracts with private companies (APPANET, 2004).

Municipal wireless projects are often seen as a route for developing future broadband wireless applications in a type of collaboration between the public and the private entities. For example, in-vehicle communication services, automated meter reading, digital video surveillance, asset or fleet tracking and monitoring, subscriber management and access control and mobile television (Mediacaster, 2006, Oct. 25).

Since 2005, several big cities and municipalities started to announce the deployment plan of mesh networks using Wi-Fi technology (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 (Woolley, 2005, July 4). Minneapolis, Philadelphia, San Francisco, Madison and Tempe have already committed to setting up wireless networks. They contracted with either small regional or large national ISPs to build and run a mesh network utilizing Wi-Fi technology: For instance, Philadelphia with Earthlink, San Francisco with Google and Earthlink, Tempe with NeoReach, Madison in Wisconsin with AOL.

The municipalities' recent efforts to deploy their own networks have been controversial but some people believe that it will be inevitable because municipalities' initiatives attract incumbents rather than pitting them against each other (Gibbons & Ruth, 2006; Cisco, 2006). In addition, the potential entrance of municipalities has been a

competitive pressure on the incumbents. A new study released by Consumer Federation of America, Consumers Union Media Access Project and Free Press shows that community Internet providers, or even the threat of municipal entry, could provide the competition necessary to keep rates low and quality of service high.⁴⁸

Table 4-3: The list of US cities and regions with public broadband initiatives

	Jul-05	Feb-06	Jun-06	Sep-06	Dec-06	Mar-07	May-07
Region/Citywide	38	56	59	68	79	81	88
City hotzones	22	29	32	43	48	57	63
Municipal or public safety use only	28	32	35	35	36	38	39
Planned deployments	34	59	121	135	149	164	195
Total	122	176	247	281	312	340	385

Source) Muniwireless.com

To realize city-wide Wi-Fi networks, many difficulties remain to be solved because regulatory barriers exist in many other municipalities. Historically, repulsion for the public entity's provision of commercial broadband services to residential users has prevailed in the U.S. in which the free market system has been the ideal. Thus, the debate over whether to allow public entities to provide commercial broadband services to residential users has not been settled yet in many states of the U.S. Albeit some states have allowed municipalities to deploy their own networks, some problems such as frequency interference with existing Wi-Fi services, and lack of standardization in equipment still linger for municipalities (The Economist, 2006, March 11). Furthermore, municipal Wi-Fi providers have struggled with low subscriber response and reliability

⁴⁸ 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 Chaska, Minnesota, \$20 in Rio Rancho, New Mexico, Moorhead, Minnesota and Lompoc, California, and an estimated \$15 in Philadelphia (Cited in Cooper, et al., 2005).

problems, and competitive responses from entrenched telecom and cable giants.⁴⁹ With those obstacles, EarthLink decided to cut its spending for municipal Wi-Fi and to focus on building out networks in cities where it already has contracts until it demonstrates the marketability of its municipal Wi-Fi service (Reardon, 2007, May 3).

In South Korea, wireless broadband usually refers to 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 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

⁴⁹ For instance, Time Warner signed with a wireless provider FON to let cable customers turn home Wi-Fi routers into public hotspots and tap into other FON users' hotspots for free. And by year end, Sprint Nextel plans WiMAX service in Chicago and Washington, with fast connections (Business Week, 2007, May 21).

Jan. 2005, the MIC of South Korea has selected three service providers: KT, SK Telecom and Hanaro Telecom (NCA, 2005).

4.2.1.4 Broadband over power line (BPL)

By slightly modifying the current power grids with specialized equipment, the BPL technology brings broadband access services to everyone with access to electricity (Figure 4-2). Usually BPL developers could partner with power companies and Internet service providers to make the service possible (Valdes, *n.d.*). 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, in rural areas in which there is relative lack of service (David, et al., 2005).

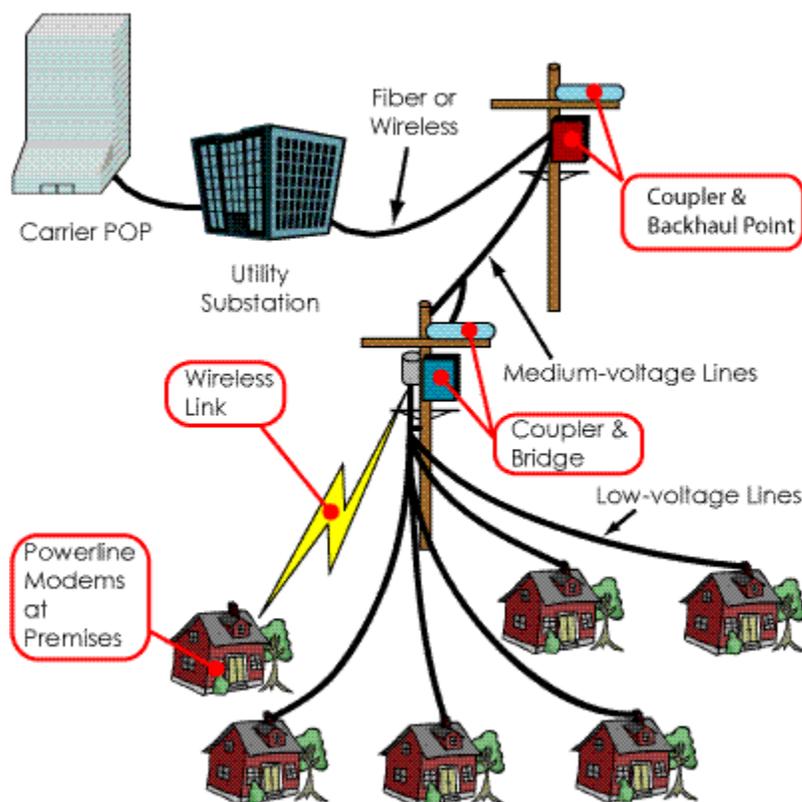


Figure 4-2: BPL in the last mile

Source) Valdes (*n.d.*)

Although there are a few commercial deployments, most BPL efforts are currently at the trial stage. Trials and commercial deployments range across the urban-rural landscape, from Cullman County, Alabama, to Cincinnati. Currently, BPL can provide upstream and downstream speeds of 3 million bits per second (Mbps), and next generation equipment is being developed to provide speeds of 100 Mbps (GAO, 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 are subject to 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). At present, BPL comes with rather high costs because of technological uncertainty, additional expenses for complementing the technological instability, and a high rate of frequency interference and noise.

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 from the former to the latter. Whether the government allows electric utilities to 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, regulation by local governments is likely. Along with technical problems, e.g., radio frequency interference, the regulatory and policy uncertainty is one of the biggest barriers to BPL providers. More recently, the FCC has clarified the regulatory stance of BPL by classifying it as an information service the same as cable modem and DSL. In August, 2006, the FCC produced supportive orders for BPL providers by listing several ways to prevent BPL from interfering with radio signals that rely on nearby frequencies (Reardon, 2006, Oct. 31).

Based upon this regulatory certainty, BPL providers have started to deploy commercial BPL services. In fact, companies in the U.S. and other countries have pilot tested BPL and many are now deploying it commercially (Figliola, 2006). Utilities serving over 50 million customers, or about 17-20 per cent of the U.S. population, have technical or market trials in progress (Blair, 2006, Jan.). For instance, Current Communications Group and TXU Electric Delivery, the largest electric company in Texas, announced that it is building a network to serve roughly 2 million homes and businesses in northern Texas. In 2005, BPL provider Current Communications Group received more than \$200 million in financial backing from major corporate players such as Google, the Goldman Sachs Group, General Electric and EarthLink. In particular, EarthLink started to explore the opportunity of the BPL technology by itself by signing an agreement with a South Korean power line communications company, Exscoms Corp., to test its BPL technology (Yonhap News, 2007, June 1).

However, many resources show that BPL would not be a third competitor and a viable solution for most Americans in truly rural areas any time soon (Lindquist, 2007, April). The FCC reports that in its “High-Speed Services for Internet Access: Status as of June 30, 2006,” the number of high-speed “lines” grew by nearly 13.5 million in the first six months of last year. Of that number, just 640 were listed as “power line and other,” an increase of some 14 percent in that category but about half the overall growth in high-speed services.

In joint comments to the FCC in 2003 on the then-pending BPL rule making proceeding, the National Rural Telecommunications Cooperative (NRTC) and the National Rural Electric Cooperative Association (NRECA) commented, “To date, no BPL system has been demonstrated to work, much less been commercially deployed, on a long, sparsely populated rural electric power line....Even if BPL technology proves to be reliable and does not cause unacceptable radio frequency interference in rural deployment, the economics will likely be prohibitive for some time to come....This is because signal repeaters or regenerators will be required at intervals as small as one-fourth to three-fourths of a mile along lengthy rural power lines in addition to the numerous and necessary network access points and backhaul lines” (cited in Lindquist, 2007, April).

Again, the NRTC cited studies by Chartwell Inc, a research company specializing in electric power topics, that found only 5 percent of utilities were moving ahead with BPL projects while 13 percent were planning or considering them. On the other hand, two utilities with more than a million customers reported discontinuing existing BPL

programs, according to a Chartwell member newsletter (Lindquist, 2007, April). Plenty of BPL projects have been rejected because of security and interference concerns. There are a few of active BPL providers such as ComTek and Current but their achievements are not as impressive yet. In addition, since BPL providers are not able to provide triple play services, they tend to prefer populace areas to realize economies of scale and avoid direct competition with the incumbents (Gubbins, 2006). The presence of multiple standards among various groups such as HomePlug Powerline Alliance (HPAA),⁵⁰ the Universal Powerline Alliance, the Consumer Electronics Powerline Communications Alliance and the Open PLC European Research Alliance has also caused concerns in the industry regarding equipment interoperability (Gubbins, 2006). Moreover, given the intensity of competition from cable modem and DSL services, a BPL access system will not be able to compete on a price-performance basis. A 2004 report from the Electric Power Research Institute shows that BPL installation charges were in the \$50-\$150 range per home passed, while CPE cost would be in the \$30-\$200 range. This is significantly higher than the cost for either cable modem or DSL (Buyer, 2005).

Consequently, new entrants with the BPL technology have to struggle not only with technological uncertainty such as frequency interference, security and standardization issues but also with economic barriers such as low profitability and costs for implementing BPL services. Since BPL is subject to a much lower level of regulatory

⁵⁰ HPPA is an industry-led initiative established to create specifications for home high-speed powerline networking products and command & control among platforms within the home, and broadband access services to the home. Membership in the Alliance has grown to include over 65 industry-leading companies. The sponsor companies are Cisco, Comcast, Earthlink, GE Security, an affiliate of General Electric Co., Intel, Motorola, RadioShack Corporation, Sharp Laboratories of America and Sony (Wireless News, 2006, Sep. 27).

control and taxation/fees unlike “telecommunications services,” its barriers are likely to be economic rather than regulatory ones.

4.2.1.5 Satellite

Broadband satellite is a capital-intensive business. As its subscriber base grows, additional satellites need to 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 aggressive they are in the subscriber acquisition game. Satellite broadband will be similar to satellite TV but more profitable than that because broadband service does not require costs for content (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 was made over telephone lines or mobile telephone networks because satellite is limited in its architecture designed for point-to-multipoint transmission in the first place. Currently, however, satellite companies provide both upstream and downstream connections via satellite, eliminating the need for a telephone line connection and speeding the overall rate of service. However, the most economical package of satellite broadband service generally offers, at this time, upstream speeds of less than 200 kilobits per second, and therefore this service does not necessarily

meet FCC's definition of advanced telecommunications services, while it does meet FCC's definition of high-speed service (GAO, 2006). In addition, customers should have a clear view of sky to be able to receive transmissions from the satellites. Additionally, transmission via satellite introduces a slight delay, which causes certain applications, such as VoIP and certain computer gaming to be ill-suited for use over satellite broadband (GAO, 2006). Thus, satellite broadband has been restricted to remote areas that find it difficult to receive fixed-line broadband Internet services like xDSL and cable modems. Satellite broadband providers are even positioning themselves not as a direct competitor but as a complement to dominant terrestrial wired broadband.⁵¹

To overcome those limitations, however, satellite providers have started to embrace terrestrial broadband technologies leaving from purely satellite-driven services. For instance, Hughes Network Systems' roll out of its Direcway Unified Broadband service in June, 2005 and Loral Skynet's embracement of wireless technology (Satellite News, 2005, June 20). As satellite network operators integrate their services with terrestrial wired and, in a few years, wireless technology, their position in the residential broadband market may change from a niche market player to a viable competitor.

⁵¹ Jon Kirchner, vice president of global marketing for Loral Skynet, told Satellite News, "What we have seen in the last three years is the realization of satellite as a point-to-point technology... We see it in a variety of different forms, whether it is Ka-band or Ku-band. What we are able to do today is to compete very favorably with terrestrial services, not as a direct competitor but more as an effective compliment to it" (Satellite News, 2005, June 20).

4.2.2 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 decreases and free installation service. As a result, despite an increase in subscribers that amount to total subscribers of 42.84 million in 2003, sales revenue slipped by 8.5% to 822.5 billion won compared to 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).

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 residential broadband access market share, as shown in Table 4-4, KT has dominated the market with 51.8% and Hanaro Telecom follows with a 23% market share. 'Others' includes smaller ISPs such as regional cable system operators, which have acquired subscribers quickly since 2001 with a 10% market share. As previously discussed in Chapter 2, broadband providers in South Korea have provided their services based on 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 (Table 4-4).

Table 4-4: 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.

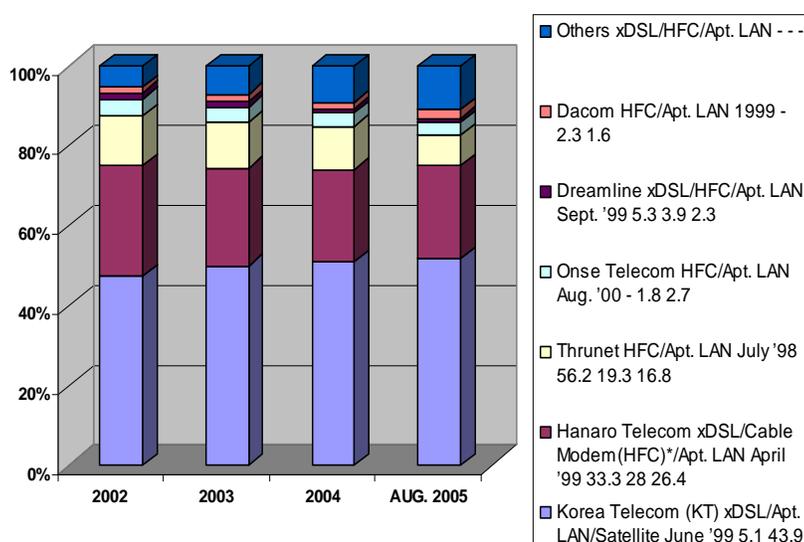


Figure 4-3: Broadband Internet market shares in South Korea (%)

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. Hanaro also acquired Thrunet in Dec. 2005, which was under legal management after

bankruptcy. Thus, the market share of Hanaro became about 32% including Dreamline and Thrunet. Currently, two dominant providers exist in the residential broadband market, i.e., KT and Hanaro Telecom. More recently, Onse telecom also exited the residential market, as turning the business over to Hanaro by selling its one subscriber for \$250 (NCA, 2006). Thus, at present (in July 2007), the residential market consists of 3 main national providers (KT, Hanaro, and LG Powercom) and regional cable system operators (Table 4-5).

Table 4-5: 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) * Exited in April, 2007 ** New entrance in Sept. 2005 *** Cable system operators

The new entries of LG Powercom in September 2005 and cable system operators since 2004 brought 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 system operators in small regions has been increasing. In June 2004, there were about 118 regional cable

system operators and a significant number of those have provided residential broadband service to mostly apartment complexes.

Similarly as in the U.S. case, the system operators have bundled cable television and high speed Internet at cheaper price than what it would be if sold separately. System operators 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 system operators on a small scale and, other main telecom companies do not seem to enter soon 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 high growth rates for the last several years but it has been decreasing recently. Since technological advances and service evolution for broadband have been much faster than for 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 deployed as complementary convergence access technologies by 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 in South Korea. Furthermore, thanks to the speedier service of VDSL (very high bit rate DSL), ADSL subscribers have been migrating to the VDSL service.⁵² 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.

In South Korea, The deployment of fundamental broadband network infrastructure was already completed in 2000⁵³ under an overarching national vision and under the guidance and supervision by the government as well (MIC, 2005). The Korean government enacted the Framework Act on Informatization Promotion in August, 1995, established the first Master Plan for Informatization Promotion in June, 1996 and established a national organization for planning and implementation of the goals outlines in the Master Plan. The Plan presented 10 projects key to realizing an advanced information society by the year 2010. In March 1999, the government established Cyber Korea 21 as the blueprint for the new information society of the 21st century in order to overcome the Asian Economic crises and to transform the Korean economy into a knowledge-based one. Since the government accomplished the initial goal of Cyber Korea 21 early, they established e-Korea Vision 2006 in April 2002 with a plan to constantly upgrade the information infrastructure and to strengthen the informatization

⁵² 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).

⁵³ It was completed construction on a high speed Information and communications network (155M-5Gbps) that connects 144 main cities nationwide in 2000 (MIC, 2005).

capacity of government, institutions and individuals, all in order to present a vision for Korea to emerge as the global leader in this area (MIC, 2002).

Currently, the South Korean government plans to build ubiquitous IT infrastructure combining high-speed communication, broadcasting networks, and sensor networks between objects. This national vision is well shown in a ubiquitous Korea (u-Korea) Master Plan (MIC, 2006, May). Under the master plan, the Korean government has adopted a top-down model which sets up a national vision and implements relevant policies under key objectives to achieve the vision. Also, a type of invest-first and pay-back policy⁵⁴ has kept drawing investors into financing IT infrastructure including a nationwide broadband network. A unified singular master plan supported and promoted by the government could make it easy for investors to make investments in the broadband infrastructure (MIC, 2005, June).

Behind the success of broadband in South Korea, the government tried to remove barriers to healthy competition. The rest was up to the market and users (Aizu, 2002). The Korean government regards broadband networks as the last mile facility just like 64 kbps public switched telephone network (PSTN) channel in the public natural monopoly era. The last mile with the advanced network facilities is just a conduit. Thus, networks' owners are supposed to function as a common carrier to new entrants and are obligated to share their networks with any party who wants to use the networks. New entrants, therefore, are able to enter the market more easily on a leased network basis.

⁵⁴ This strategy refers to a strategic approach which makes providers invest first then reap profits later under the guidance of the government. Once the government sets the plan, the private party participates in building up the networks with cooperation with the government. This is a totally government-led program.

4.3 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 they are essential facilities in a market has been a key question to determine the degree of monopolistic control by the incumbent. New entrants must get reasonable access to that facility if it is feasible to do so. Without such access, new entrants have to face a substantial cost disadvantage in contrast to incumbents. In case incumbents have no incentive to provide new entrants (or competitors) access to essential facilities (e.g., the last mile networks and network elements such as transport networks and switching servers), 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 advocacy groups and researchers (Selwyn, et al., 2005; Turner, 2005, 2006; Marcus, 2006) point out some constraints 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. The 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) argues 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.

As previously mentioned, in order to ensure 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 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 & Thong, 2003, cited in Lau, Kim & Atkin, 2005).⁵⁵

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), the facilities provision rules, and the availability of LG Powercom's cable network for rent, there is no concern about essential facilities.

In addition, the revision of the Broadband Cable Television Law in January 1999 enabled cable system operators 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

⁵⁵ Yan, X., & Thong, J. (2003). Tariff-quality equilibrium and its implications for telecommunication regulation. *Telecommunications Policy*, 27, 301–315.

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 on 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 Framework Act on Telecommunications⁵⁶ requires cable system operators to get a license from the Ministry of Information and Communications (MIC) to provide cable telephony services.

In 2004 July, through an amendment to the Telecommunications Business Act,⁵⁷ the MIC designated the high-speed Internet service, which had been categorized as a value added service, as a basic service. After the two-year grace period, cable system operators, relay operators and network operators that are providing broadband high-speed Internet services as value added telecom service operators are required to obtain a basic telecom service license by July 2006. The MIC will revise its notification on guidelines for basic telecom license application and examination criteria to help cable operators,

⁵⁶ Cheonki Tongsin Kibonbop

⁵⁷ Sec. 3, revised on July 20th, 2004.

which are already providing the high-speed Internet service in a small scale on a regional basis, apply for Internet connection services with ease. Cable operators are expected to be at a relatively advantageous position than the existing basic telecom service operators in the application for the basic telecom service as they will be subject to simpler screening processes (MIC Policy News, 2006, April 7).

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

Despite these favorable policies towards new entrants, Kim and Lee (2005) illustrate how much market power KT has enjoyed in telecommunications market. In a bid for supplying 50 Mbps VDSL equipment, equipment manufacturers argued against price discounts that KT asked for 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, cited in Kim & Lee, 2005). It is rare that the buyer of equipment negotiates prices with raw material providers. Thus, this case indicates that 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.

4.4 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. Sunk costs are defined in the U.S. Merger Guidelines as “the acquisition costs of tangible or intangible assets that cannot be recovered through redeployment of these assets outside the relevant markets.” Sunk costs are central to the calculations of potential entrants because if entry involves significant sunk costs, it will be deterred if they are unlikely to be recouped, and incumbents may be able to exploit this fact. If the relevant market of broadband access services embraces all Internet service market, the transmission and last mile facilities may be recycled in other service markets such as voice and video services. In this case, these are not sunk costs.

However, routing facilities will be sunk costs because they cannot be recycled for purposes other than Internet access service itself. If a market existed for narrowband Internet, part of the routing facilities and equipment initially deployed for high speed Internet could be reused, in which case those expenses would not be sunk: however, the narrowband Internet access market in South Korea has been rapidly fading and there has been no new investment in the narrowband market (Kim & Lee, 2005). Thus, routing facilities are sunk in this event. 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.

Both in the U.S. and in South Korea, dominant telecommunications providers continue to control the last mile networks, indicating the presence of both economies of

scale and scope (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). Furthermore, the ability to provide a "triple play" services would strengthen the benefits of economies of scope at the time triple play services are regarded as a critical element for competition.

Although the importance of economies of scale and scope has been and will be declining because of dropping costs for service provision thanks to technological innovation, incumbents still have absolute cost advantages resulting from economies of scale and scope. Kim and Lee (2005) estimated the minimum viable scale of entry (MVS)⁵⁸ of residential broadband market by using Stigler's survival test and concluded that 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 sometime soon, capital requirements for new entrants would be greater. A report by the government (GAO, 2006) also confirms that population density—which is the population per square mile—was a critical determinant of companies' deployment decisions because of consideration of cost requirements.

⁵⁸ MVS refers "the total sales a hypothetical new entrant would need to achieve in order to earn a sufficient rate of return on capital invested in order to justify entry" (cited in OFT, 1994, p.32).

However, firms with economies of scope, such as LG Powercom and system operators which can provide a cable television service together, may not require as much additional capital for entering the residential broadband market. Also, there are potential new entrants originating from non-telecom businesses that have access to adequate financial assets when entering the market. This spill-over entrance (Ford, et al., 2005) may be from electric utilities, for instance, Korea Electric Power Co. (KEPCO) in South Korea owns power line communications networks (PLC; BPL in the U.S.) through which it can provide broadband access service. In the U.S., several electric utilities have joined with private entities to provide the broadband services over the power line (Brown, 2005).

As a result, to serve the residential users, new entrants are expected not only to install their own networks but also invest in customer services and employing technicians. Capital requirements are different depending on the scale of entry required to make entry profitable, either nationwide or regional. It is, however, obviously true that the entrance into the residential end-users' market requires a tremendous amount of capital (GAO, 2006). Even Wi-Fi service, a well-known cost effective technology, needs to input a great deal of capital into installing as many access points as required and managing the networks later on.

4.5 Product Differentiation, Advertising, Switching Costs and Network Externalities

Product differentiation is not always a barrier to entry. It can be a means of entry. However, it is important for new entrants because other forms of entry barrier are related to product differentiation. For instance, brand proliferation, advertising, switching costs

and network externalities are all associated with product differentiation (OFT, 1994). If used strategically by an incumbent, product differentiation can be one of the most formidable barriers to entry (Bain, 1956; Porter, 1980; Karakaya and Stahl, 1989). Advertising impedes entry since necessary advertising expenditures give rise to a sunk cost which raises the risk of entry.

However, thanks to advertising, new entrants perceives a greater likelihood of success in markets where advertising is important. Thus, the overall impact of advertising on entry is positive (Kessides, 1986). Furthermore, an incumbent may create brand awareness and brand loyalty through advertising. On this occasion, product differentiation partly eliminates the effect of low pricing for entrants because customers become less price-sensitive.

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 attempted to expand their customer base by differentiating the high-speed Internet based on speed. 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, since July 2005, 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. 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).

4.5.1 Brand recognition

In terms of brand recognition, KT among the dominant providers has shown the highest recognition rate (61%) in a survey in 2004. 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 system operators in terms of users' favor level (KISDI 2004 survey, cited in Kim and Lee, 2005).

Although there is no comparable survey in the U.S., we may presume that dominant telephone and cable companies' brand recognition and brand power must be huge in the U.S. as well. One market survey company shows that the brand recognition rates of telephone and cable companies are really high compared to other industry leaders although internet companies such as Google, Yahoo and eBay have better brand recognition rate (Salient Marketing, 2005). In particular, telephone and cable companies are in a group of top national advertisers (MarketWatch, 2006, Sep. 6). Among total advertisement expenditures for January through June in 2006 (about \$73 billion), the top five advertisers were AT&T, Verizon and Time Warner with Procter & Gamble Co. and General Motors Corp.

4.5.2 Switching costs

In the case of switching a provider, the remaining 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 as many subscribers as possible in South Korea. Also, given that modems have been standardized, switching costs of broadband service access have been minimal. In the U.S., switching costs between DSL and cable modem has been negligible. However, since most DSL and cable subscribers are tied with a long term contract and cancellation penalty fee in case of switching providers, they tend not to often change their broadband providers (Hall, 2006, Sep. 30). Satellite has required a substantial amount of installation fee, on average, several hundreds of dollars.

4.5.3 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, subscribing for networks with more subscribers will 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 exist in the broadband access market.

4.6 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.⁵⁹ New entrants can enter the market by leasing the networks of LG Powercom, originated from KEPCO's optical fiber networks, on which system operators 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

⁵⁹ Which are the same as the UNEs rule and line sharing rule in the U.S.

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 to competitors.

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).⁶⁰ 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 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 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 amounts to total \$80-100 per month (Cooper, et al., 2005).

⁶⁰ 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).

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 2005.⁶¹

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

⁶¹ 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).

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.

In contrast, the Korean government has banned vertical exclusion in the telecommunications market. For example, the MIC in South Korea bans exclusive agreements between mobile phone service operators and content providers for wireless Internet services (MIC policy news, 2001, Sep.6). The move is intended to breathe life into the nascent wireless Internet service market and protect the rights of content providers, who are at a distinct disadvantage when negotiating with mobile phone operators. The ministry plans to introduce these measures to create an environment for fair competition in the wireless Internet service market.

4.7 Predatory Behavior

Koski and Majumdar (2002) examined whether new entry into the U.S. local exchange markets affects the behavior of ILECs in terms of pricing, advertising and the extent of diversification. The authors found that the reaction strategy of ILECs is not in terms of aggressive pricing but through advertising, and ILECs cut back the extent of diversification when they face the entry of a new competitor. As previously shown, the same thing happens in the broadband market in the U.S. While ILECs have provided a kind of introductory ADSL service at a dial-up price, the incumbent cable companies have never responded with price to that price reduction. Although cable companies have not straightforwardly responded with price to the competitive pressure, new entrants may feel it inappropriate to enter the residential market because they think they cannot beat telephone companies' low price of residential ADSL services and there is a 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 a theory of the deep pocket (Kim & Lee, 2005). 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, reduced 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 exits, however, KT would not be able to increase its service price post-exit unless the market came 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 it harder for KT to increase prices by taking subscribers away from KT and make KT fail to raise profits even after a price increase. Second, regional cable system operators have been increasing their market share by offering cheaper services, mostly in areas adjacent to their franchising areas. However, KT has responded with quality and service competition to this competitive pressure rather than price competition. Once KT competes with system operators in price, KT should bring down its own price. In this case, the overall profits KT could obtain would be diminishing, although it could take subscribers away from system operators. 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.

4.8 Assessment of Entry Impediments

Even if there are no barriers to entry, entry might nevertheless be delayed by impediments to entry (OFT, 1994). In the broadband access market of South Korea, the only discernable barrier to entry was nothing but obtaining a license (Kim & Lee, 2005). 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 like the early entrants, and without regulatory certainty, would be too risky to decide to enter.

4.9 Conclusion

This comparative study of entry barriers in the U.S. and in South Korea under the OFT's evaluative framework results in the following table with some limitation of data, (Table 4-6). As for the number of new entrants from 1999 to 2004, the U.S. did not distinguish the number of entrants by alternative access technologies until 2005.

Table 4-6: Comparison of barriers to entry by platforms in the U.S. and South Korea

	The United States			South Korea		
	Barriers to Entry	No. of Entrants*	Growth Rates*	Barriers to Entry	No. of Entrants	Growth Rates

Entrance with Facilities	Wireless BPL Satellite	-Capital requirements (spectrum) - technological factors (standardization uncertainty, interference) -Expected profitability -Economies of scale/scope -Sunk cost	247	380%	-Capital requirements (spectrum) -Technological factors (standardization uncertainty) Sunk cost	N/A	N/A
Entrance without facilities	DSL	-Essential facility -Economies of scale/scope -Predatory pricing	324	1157%	-Economies of scale/scope	78**	N/A
	Cable Modem		104	242%			

* Only the number of entrants from Dec. 1999 to Dec. 2004 included and the numbers under “all other” by the FCC’s categorization are included. All other includes SDSL, traditional wireline, fiber, satellite, fixed and mobile wireless and power line.

** NCA (2006). The number of entrants with facilities only counts wireless LAN service providers, which are all incumbent broadband network owners. New entrants without facilities tend to either lease DSL or cable networks or partly own broadband networks like cable system operators

In South Korea, major broadband access companies not only have their own facilities but also provide services on other platforms (e.g., providing both cable modem and DSL). The number of entrants with facilities only counts wireless LAN service providers, all of which are incumbent broadband network owners. New entrants without facilities tend to either lease DSL or cable networks or partly own broadband networks like cable system operators.

More importantly, entrance into the residential market would usually entail a high level of capital requirements and economies of scale and scope in both countries. Even though there are enough costs and profitability to attract entry, technological barriers of alternative access technologies, e.g., technological uncertainty, interference and spectrum management issues make entry difficult. South Korea, however, is pursuing mobile wireless broadband (e.g., WiBro) more than fixed wireless services. Most fixed wireless

facilities (WLL and Wi-Fi) have been deployed as complementary to the incumbent networks. This may be resulted from the presence of fair enough competitors in the residential wired networks in South Korea. Facilities-based fierce competition in broadband access has led existing providers to diversify their services and to struggle to differentiate their products. New entrants without facilities can lease the networks from either KT or LG Powercom.

In contrast, prospective new entrants without facilities in the U.S. tend to face higher barriers to entry in the residential market because their post-entry profitability would not cover their costs. Even though they choose alternative access platforms such as BPL, wireless and satellite, those alternatives are not necessarily cost-effective and profitable. Even wireless technologies could help overcome some of the cost and technological limitations to providing service, but congestion and the management of the spectrum remain possible barriers. To overcome entry barriers, satellite and wireless network providers in the U.S. have diversified with their business plan by cooperating with other access providers.

Product substituters exist under the current U.S. and South Korea's markets because the market definitions presented by both governments include all other alternative access technologies. Thus, assuming that customers are not sensitive to the type of access technologies, different platforms are seemingly substitutable. However, this is sometimes not true. As previously examined, each technology has its own features and niche functions. More importantly, wireless options are not viable competitors yet against wired counterparts. This also applies to satellite and BPL options. The providers

of those technologies may probably successfully enter the residential market in the near future but the current picture of the market portrays that incumbent DSL and cable modem providers would keep leading the residential market with economies of scale and scope, and even with new entrants, the magnitude of entrance would not match up to that of the incumbent telephone and cable companies.

Chapter 5

Reality Check: The Presence and Perceived Importance of Barriers to Entry in the Residential Broadband Market

5.1 Introduction

Explicitly recognizing 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 for establishing a proper competition policy. Although market entry barriers are crucial industrial factors that influence the market share and profit of firms already in the market, very little empirical research has specifically examined barriers in the telecommunications and broadband industry. Given the lack of competition in the residential broadband access market, this paper conducted a mail survey and interviews to examine the presence of barriers to entry and the perceived importance of entry barriers in the residential broadband access market.

The underlying industry-level factors that prevent new entry into the market are also investigated by using a factor analysis based on the previous literature. The factor analysis can discern the regularity and order in phenomena. Notably, the survey does not demonstrate the presence or absence of barriers to entry by themselves but produce perceived presence and importance of barriers to entry. The ultimate purpose of this research is to contribute to the debate over new telecommunications policy decisions by

identifying barriers to entry in the market, if any, and by suggesting which barriers should be addressed by the government in the interest of promoting a more competitive market.

5.2 Research Objectives

New competitors consider more than a single barrier to entry when they enter the market, and they are not likely to weigh each barrier equally and individually (Karakaya, 2002). This research project aims to examine the importance of barriers to entry as perceived by executives of broadband access providers and the possible presence of entry barriers based upon a survey and interviews. The following research questions are addressed:

RQ1. Which entry barrier(s) is perceived as the most important in deterring businesses from entering residential broadband markets?

RQ2. What are the underlying dimensions of barriers to entry in the residential broadband access market?

Recently, the FCC produced a Notice-of-Inquiry (NOI) questioning the market practice in the broadband services market. The NOI seeks information on deployment, availability, affordability, and competitiveness of broadband services. For instance, the behavior of broadband market participants, including how broadband providers are managing Internet traffic on their networks today and whether providers charge different prices for different speeds or capacities of service (FCC, 2007, April 16). Responding to the inquiry, the results of this research project provide insights into market practice

associated with competition and barriers to entry that may contribute to relevant policy development. In addition, the research will add theoretical insights into the previous barrier studies by verifying the importance of barriers to entry in the real market situation.

5.3 Literature Review

As examined in Chapter 3, the concept of barriers to entry has been defined differently based on whether it focuses on above-normal profits of incumbents (Bain, 1956) or cost difference between incumbents and new entrants (Stigler, 1968). Based upon this distinction, previous economic literature discussed which industrial factors should be included as barriers to entry in general terms. Bain (1956) identifies economies of scale, capital requirements, absolute cost advantages, and differentiation advantages as important factors that can create barriers to entry. Stigler only includes absolute cost advantages, access to distribution channels, switching costs, brand loyalty and vertical foreclosure excluding economies of scale and capital requirements as important industrial factors that deter a new entry. From the strategic management school perspective, Porter (1980) specified six major sources of barriers to entry: economies of scale, product differentiation, capital requirements, switching costs, access to distribution channels and cost advantages independent of sale such as favorable access to raw materials and government subsidies.

Most empirical studies have been limited to an industrial analysis focusing on which industry has more (or higher) barriers compared to other industries (Bain, 1956; Schmalensee, 1989; Carlton & Perloff, 2005). As it is important in many antitrust contexts to go beyond the Bain and Stigler definitions, which takes into account the dynamics of entry (Carlton, 2005 and McAfee et al., 2004), researchers should consider market-specific characteristics since barriers in deterring entry of competitors into markets vary by product and industry (Karakaya & Stahl, 1989; Yang, 1998).

5.3.1 Barriers to entry in the telecommunications market

As identified by Ford, Koutsky and Spiwak (2005), two critical factors drive the entry decision in the telecommunications market: (1) post-entry profitability and (2) entry costs. Firms will enter a market only if they expect to make a positive post-entry profit—the authors identified that market size, the intensity of price competition, the level of product differentiation and the existence of rival networks would determine the post-entry profit of a new entrant. The second factor, entry costs are also 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).

Also, 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. While Stigler's definition of barriers to entry (that does not include economies of scale) has been well accepted among modern economists, some economists

identify scale economies as a critical barrier (Geroski, et al., 1990; Nahata & Olson, 1989; Gabel, 2002).

Providing residential telecommunication services requires firms to incur substantial upfront investments in physical plant and advertising. A great portion of the investment will be irrecoverable in the event of exit. The irrecoverable costs are called sunk costs. Sunk costs are particularly important when new entrants decide to enter the residential telecommunications business, which requires considerable investments to construct local distribution networks and advertisement (Ford, et al., 2005). Xiao and Orazem (2005) found in an empirical study that sunk costs are the main determinant of entry in the residential broadband access market. The interaction of sunk costs with economies of scale to create barriers occurs in the telecommunications market (Gabel, 2002; Sidak, 2006). Furthermore, regulation and competition policy will greatly influence a decision of new entry by changing environmental factors (Alexander & Feinberg, 2004; Brown & Zimmerman, 2004; Rosston & Wimmer, 2001; Abel & Clements, 2001).

5.3.2 Previous analyses of barriers to entry in several industries

Several pioneering empirical studies from marketing and business schools deal with a wide range of manufacturing and retail industries: they provide a relevant theoretical framework and methodological suggestion for this research paper. Karakaya and Stahl (1989), in a mail survey of 60 *Fortune 500* companies, identified cost advantages of incumbents, product differentiation of incumbents, capital requirements, customer switching costs, access to distribution channels, and government policy as

important barriers to entry. Amongst these factors, the cost advantages of incumbents are perceived as the most critical for all market entry decisions. The capital requirements barrier and product differentiation barrier follow as the second and the third most important barriers in both consumer and industrial goods markets. Expanding this study, Karakaya and Stahl (1992) identified 25 market entry barriers again in consumer markets. The first factor “incumbent structural advantage” listed 13 barriers dealing with the cost and structural advantages of incumbents. The second factor “incumbent market strength” included seven barriers that were related to brand recognition by consumers as well as other company strengths. The third factor “entrant financial investment” comprised five investment-related barriers to entry.

Karakaya (2002) extended the previous studies about consumer markets into the industrial market and conducted a mail survey of 500 industrial firms. From the 93 companies, which responded, it was found that a majority of business executives consider cost advantages and capital requirements to enter markets as the two most important barriers to entry followed by incumbents’ access to a superior production process, capital intensity of the market, and customer loyalty. In addition, he identified four factors: firm specific advantages, product differentiation, cost of market entry and profit expectation of entering firms. In terms of relative importance, the cost of market entry had a significantly higher score compared to the other factors.

These studies are important because they were the first to empirically examine the relative importance of entry barriers. To summarize, business decision-makers perceived that new entrants would decide their entry based on the absolute cost advantages held by

incumbents, capital requirements for entering a market, and product differentiation. In particular, capital requirements in industrial markets seem perceived more critical than in consumer markets

5.4 Methodology

5.4.1 Survey: data collection

The FCC reports that the number of high-speed Internet service providers increased significantly from 105 in 1999 to 552 in 2004. If providers with less than 250 lines are included, the total number of providers was 1269 in June, 2005. This increasing number indicates that many smaller companies are operating locally. However, since there was no comprehensive list of broadband access service providers available, two resources were used to formulate a survey company list: *Hoover's Online Database* and a company-member list from Comptel, a trade association in the telecommunication market.

The same survey procedure was conducted twice over a time period of three months, first for companies from Hoover's Online Database and later for companies from the Comptel list.⁶² First, 312 companies chosen from *Hoover's Online Database* were mailed a personalized cover letter addressed to an executive per company, who is in a position to make a market entry decision or contribute to the decision (e.g., CEO, president, vice president or vice president of marketing). An implied consent form, a two-

⁶² Refer to <http://www.comptel.org>

page of questionnaire and a postage-paid return envelope were mailed as well. The questionnaire listed 25 barriers to entry and asked respondents to rank them according to their perceived importance to his or her firm/industry. The executives were asked either to respond to the paper questionnaire offline and send it back to the researcher by mail or to submit the responses online.

Second, after a month, the second survey was sent out to 133 broadband access companies obtained from the Comptel list, which were not duplicated in the previously conducted survey. They were mailed a questionnaire following the same procedure as indicated above. This second round was intended to gain more responses because the first survey produced a low response rate (< 10%). We obtained an endorsement from Comptel to encourage their member companies to respond to the survey. Thus, a total of 445 companies were selected and contacted through the two conducted surveys. Still the response rate was not very high possibly because the target was high-ranked executives in the company. Due to address and personnel changes, a total of 28 surveys were not deliverable. The number of responses analyzed for this study turned out to be 53 in total, for a 12% response rate. Even though 100 or more cases would be much preferable for detecting the underlying dimensions, 53 cases would be still acceptable because the clearer the true factor structure, the smaller the sample size needed to discover it (Darlington, *n.d.*). Since this research instrument is based on items that a previous study has identified as items with a clear factor structure, we argue that a smaller number of cases would suffice.

Indeed, when we calculated two diagnostic tests for the adequacy of factor analysis, the tests have all produced satisfactory results. First, the KMO (Kaiser-Meyer-Olkin) measure of sampling adequacy⁶³ was calculated and the result shows that factor analysis can proceed (The KMO value = .704). Second, Bartlett's test of sphericity rejects the hypothesis (at $p < .001$) that the correlation matrix is an identity matrix, without significant correlations between variables, which confirms that the data are suitable for factor analysis (Colman & Pulford, 2006).

The questionnaire asked the respondents to evaluate the importance of 25 entry barriers on a *Likert* scale ranging from "very important" to "not important at all." The 25 entry barriers were derived from a previous study (Karakaya, 2002) which measured the barriers to entry in industrial markets. However, as indicated previously, the telecommunications industry has different characteristics from other industrial markets. Thus, a total of 5 items were modified to reflect the specific features of the market situation based on the previous literature. For instance, one item from Karakaya (2002), "incumbents with proprietary product technology" was replaced with "incumbents with essential facilities such as the last mile networks, which may restrict access to new entrants." The entire list of factors is found in Table 5-2.

⁶³ When the KMO value is above .50, this indicates the adequacy of factor analysis (Colman & Pulford, 2006).

5.4.2 In-depth interview

To complement the survey, interviews with executives were conducted. The main task in interviewing is to understand the meaning of what the interviewees say (Kvale, 1996). Although interviews are time consuming and resource intensive, they are useful for pursuing in-depth information around a topic. Also, interviews may be useful as follow-up to certain respondents to questionnaires, e.g., to further investigate their responses (McNamara, 1999). Furthermore, unlike with mail surveys, interviews provide the opportunity for an interviewer to probe or ask follow up questions. For this research, a type of standardized and open-ended interview was adopted. The open-ended interview refers that the same open-ended questions are asked to all interviewees. This approach facilitates faster interviews that can be more easily analyzed and compared (McNamara, 1999).

We contacted all 133 companies from the Comptel list, cordially inviting them for an interview by phone. Finally we interviewed executives of a total of 13 companies, some of which already responded to the survey. The interview asked questions similar to the survey but was intended to get information about the current market situation and relevant regulatory issues in depth. Thus, the interview questions addressed the competition level in the respondent company' market, deciding factors in case the company decided not to enter the residential market, and interviewees' perceptions on what barriers to entry exist in the residential broadband access market, which barriers are most important to the participating company, and which barriers should be tackled by the government (Table Table 5-1).

Table 5-1: Interview questions

Categories	Questions
General Information	<ul style="list-style-type: none"> • How long has your company been at your current address? • Did your company enter the broadband service access market? When? • Do you provide high-speed Internet access service to the residential users? • What access technologies has your company used for the broadband service provision?
Perceived Competition Level	<ul style="list-style-type: none"> • Is there competition in the region where your company provides the service? How much?
Deciding Factors	<ul style="list-style-type: none"> • If your company decided not to enter the residential broadband market, why not? What was the deciding factor?
Perceived Barriers to Entry	<ul style="list-style-type: none"> • What barriers to entry exist in the residential broadband access market?
	<ul style="list-style-type: none"> • Which barriers are most important to your company?
	<ul style="list-style-type: none"> • What barriers should be addressed by the government? What role should the government take to remove barriers to entry?
Others	<ul style="list-style-type: none"> • In addition to the barriers you noted, what other obstacles or difficulties exist when your company tries to enter the residential broadband access market?
	<ul style="list-style-type: none"> • Any other comments?

On the other hand, to preserve confidentiality, each participant was assigned a code number. The code number is matched with the participants' identity only on a master list—in the analysis, only the interviewee's code number was used. Each interviewee participated on a voluntary basis and they were promised a copy of the final report after the research is done. With a few exceptions, all the ten interviews were recorded and transcribed by the researcher— some interviewees did not want to be recorded.

5.5 Analyses and Findings

This section reports the results of the survey first and turns to the interview analysis. The survey analysis includes a mean score comparison and a factor analysis that

detects the underlying structures of ranked items. 50% of total respondents are DSL and business broadband providers. 64% of respondents have already entered the residential market and 74% of responding companies are small and medium size with less than 200 employees. Also, most responding companies (70%) completely or partly owns broadband access facilities.

5.5.1 Perceived importance of barriers to entry

Examination of the mean scores indicated that capital requirements (mean = 6.26), capital intensity (mean = 6.09), incumbents with essential facilities (mean = 6.06) were the three barriers perceived as the most important by executives who responded to the survey. Table 5-2 shows the mean scores and standard deviations for each of the barriers tested.

Table 5-2: Importance of barriers to entry in the residential broadband access market

Barriers to entry in the residential broadband market	Mean	Std. dev.
Capital requirements to enter markets	6.26	0.763
Capital intensity of the market	6.09	1.024
Incumbents with essential facilities such as the last mile networks, which may restrict access to new entrants	6.06	1.586
Amount of sunk cost involved in entering a market	5.83	1.033
Incumbents with cost advantages due to economies of scope (e.g., tying with video and/or telephone services)	5.51	1.648
Magnitude of market share held by incumbents	5.30	1.409
Incumbents with cost advantages due to economies of scale	5.25	1.807
Incumbents with relatively easy access to necessary equipments and supplies (e.g., vertical integration)	4.98	1.575
Low prices charged by incumbents	4.96	1.860
Heavy advertising by firms already in the market	4.85	1.460
Government policy (e.g., licensing requirements)	4.74	1.903
Amount of selling expense involved in marketing a product	4.72	1.498
Brand identification advantage held by incumbents	4.70	1.600
Incumbents with excess capacity, which may prevents new entrants from offering their services	4.62	1.873
Expected post-entry reaction of incumbents	4.57	1.771
Number of firms in a market	4.51	1.527
Customers' costs associated with switching from one supplier to another	4.38	1.667
Incumbent's easier access to distribution channels (e.g., more selling agents)	4.36	1.699
Incumbents with superior production processes	4.13	1.630
High profit rates earned by incumbents	3.75	1.921
Incumbents with cost advantages due to learning curves (The more experience, the better cost efficiency)	3.68	1.626
Customer loyalty advantage held by incumbents	3.66	1.605
R&D expense involved in entering a market	3.62	1.632
Patent, intellectual property	3.30	1.761
Trade secrets held by incumbent firms	3.15	1.758

5.5.2 Underlying dimensions of barriers to entry

In order to identify the underlying dimensions of barriers to entry in the broadband access market, the 25 barriers were factor analyzed using principle axis

factoring with a varimax rotation. The criteria established in advance of the selection of factor items were: (1) a factor loading of 0.35 or higher; (2) at least a 0.10 difference between the item's loading with its factor and each of the other factors, and (3) interpretability.

In deciding how many factors to retain statistically, Cattell's scree test was utilized.⁶⁴ The scree test showed that there was a marked decrease in downward slope after four and five principal components implying that we can summarize our 25 barriers variables either by the first four or by five principal components. Both four and five factors had eigenvalues of greater than 1.0. Thus, conceptual considerations guided the final decision over the number of factors. Conceptually, four factors made more sense than five factors. With five factors, one factor contained items with no meaningful relationship to one another, e.g., "incumbents with cost advantages due to learning curves" and "number of firms in a market." In comparison, the four-factor solution produced an interpretable factor structure with barriers loading on the factors in a meaningful way.

Nevertheless, when varimax-rotated factor loadings were run with four factors, two items—"customers' costs associated with switching from one supplier to another" and "number of firms in a market"—produced statistically weak loadings less than the criterion of 0.35. Thus, they were excluded in the final factor-loadings, resulting in 23 items analyzed. In addition, one item, "incumbents with cost advantages due to learning

⁶⁴ Traditionally, there are many ways to choose the number of factors but most factor analyses depend on Kaiser's familiar eigenvalue rule or Cattell's scree test. But there are arguably more advanced methods suggested (Darlington, *n.d.*)

curves (the more experiences, the better cost efficiency),” was included in Factor 1, product differentiation, even though it is supposed to fit in Factor 2, absolute cost advantages. Low prices charged by incumbents in factor 2 can be arguably a part of product differentiation.

The number of factors is the number of substantively meaningful independent (uncorrelated) patterns of relationship among the variables. As can be seen from Table 5-3, there are four independent patterns of relationship in the data. These may be thought of as evidencing four different kinds of influence on the data as presenting four categories by which these data may be classified. The percent of total variance shows the percent of total variation among the variables that is related to a factor pattern. This figure measures the relative variation among total responses in the original data matrix that can be reproduced by a pattern. It measures a pattern’s comprehensiveness and strength (Rummel, *n.d.*).

The first factor delineates the largest pattern of relationships in the data; the second delineates the next largest pattern that is independent of (uncorrelated with) the first; the third pattern delineates the third largest pattern that is independent of the first and second; and so on. Thus the amount of variation in the data described by each pattern decreases successively with each factor; the first pattern defines the greatest amount of variation, the last pattern the least. *Eigenvalues* measure the amount of variation accounted for by a pattern. Dividing the eigenvalues by the number of variables and multiplying by 100 determines the percent of total variance (Rummel, *n.d.*).

Table 5-3: Rotated factor matrix showing the underlying dimensions of barriers to entry in the residential broadband market

	Factors			
	1	2	3	4
Factor 1. Product differentiation				
Heavy advertising by firms already in the market	.730	.160	.094	.097
Incumbents with cost advantages due to learning curves (the more experience, the better cost efficiency)	.646	.245	.174	-.131
Incumbents with superior production processes	.631	.284	-.007	.064
Trade secrets held by incumbent firms	.596	.118	.517	.112
Customer loyalty advantage held by incumbents	.576	-.153	.146	-.162
Amount of selling expense involved in marketing a product	.544	-.026	.085	.315
Brand identification advantage held by incumbents	.519	.270	.084	.249
Incumbent's easier access to distribution channels (e.g., more selling agents)	.505	.233	.249	.010
Factor 2. Absolute cost advantages				
Incumbents with essential facilities such as the last mile networks, which may restrict access to new entrants	-.157	.802	.157	.251
Incumbents with cost advantages due to economies of scope (e.g., tying with video and/or telephone services)	.344	.693	.250	-.142
Incumbents with relatively easy access to necessary equipments and supplies (e.g., vertical integration)	.409	.672	.070	.112
Incumbents with cost advantages due to economies of scale	.451	.554	.279	.051
Low prices charged by incumbents	.042	.479	.101	.008
Incumbents with excess capacity, which may prevents new entrants from offering their services	.319	.466	.161	.059
Factor 3, Post-entry profitability				
Patent, intellectual property	.024	.061	.818	.403
High profit rates earned by incumbents	.150	.230	.807	.028
Magnitude of market share held by incumbents	.228	.249	.568	.143
Expected post-entry reaction of incumbents	.212	.304	.490	.236
R&D expense involved in entering a market	.245	.206	.386	.159
Factor 4 Entry costs				
Capital intensity of the market	-.053	.023	.061	.872
Capital requirements to enter markets	.132	.167	.119	.794
Amount of sunk cost involved in entering a market	.126	.156	.277	.694
Government policy (e.g., licensing requirements)	.001	-.130	.385	.539
Eigenvalues	7.3	3.01	1.98	1.62
% of variance explained	31.88	13.09	8.62	7.06
Cronbach's Alpha	.84	.82	.81	.76

The four factors extracted account for 57.4 percent of the variance in the data. In addition, Cronbach's alpha was calculated for each factor to assess the reliability of the resulting scale. The reliability coefficients calculated are 0.84, 0.82, 0.81, and 0.76 for

factors 1, 2, 3, and 4 respectively (Table 5-3). Finally, composite scores were obtained on each factor for every subject by calculating the mean of the relevant item response scores to compare means.

Factor 1: Product differentiation

The first factor accounts for 31.88 percent of the variance and it is labeled as “product differentiation” as suggested by Karakaya (2002), who identified the same factor. A total of eight barriers-to-entry structure this factor including heavy advertising by firms already in the market, customer loyalty advantage held by incumbents, the incumbent’s stronger brand identification, amount of selling expense involved in marketing a product, incumbent’s easier access to distribution channels (e.g., more selling agents), incumbents with cost advantages due to learning curves (the more experience, the better cost efficiency), incumbents with superior production processes and trade secrets held by incumbent firms. Karakaya had included switching costs as an item in this factor but this variable was excluded as previously indicated. Also, cost advantages due to learning curves, incumbents’ superior production processes and trade secrets held by incumbent firms were newly added to this factor. Except for the amount of selling expense involved in marketing a product, all other variables are associated with product differentiation utilizing advertising, superior production processes and distribution channels. Also product differentiation can be achieved from brand power and customer loyalty that incumbents usually benefit from the first-mover advantages.

Factor 2: Absolute cost advantages

The second factor accounts for 13.09 percent of the variance and is labeled as “absolute cost advantages.” Absolute cost advantages can be defined as costs that must be borne by the entrant but not by incumbents. This includes the incumbent firm’s exclusive or superior access to necessary inputs such as patents, copyright, exclusive contracts with input suppliers and ownership of a network. Most legal and regulatory barriers to entry come under this heading. Cost asymmetries due to the superior efficiency of incumbents, however, should not be included. A total of six barriers to entry make up this factor. Except for low prices charged by incumbents and incumbents with excess capacity, all others appear to be related to absolute cost advantages held by incumbents: the ownership of a network (incumbents with essential facilities such as the last mile networks, which may restrict access to new entrants), incumbents with cost advantages due to economies of scale, incumbents with cost advantages due to economies of scope, and incumbents with relatively easy access to necessary equipments and supplies (e.g., vertical integration). It should be noted that the incumbent’s low prices and excess capacity seem more relevant to the post-entry profit expectation of new entrants. Incumbents’ deterrence strategies will function here by reducing the potential competitors’ profit opportunities by imposing high costs for new entrants by lessening the market price of a product (Rosenberg and Clements, 2000) rather than by engaging in price competition.

Factor 3: Post-entry profitability

The third factor is labeled as “post-entry profitability” and accounts for 8.62 percent of the variance. The barriers such as high profit rates earned by incumbents, the market share of incumbents, expected post-entry reaction of incumbents, patent, intellectual property, and R&D expense involved in entering a market make up this factor. Both patent and intellectual property and R&D expense involved in entering a market are relevant in that they raise entry costs to new entrants and later operational spending. Thus, they influence expected profitability eventually.

Factor 4: Entry costs

As shown in this factor, capital intensity and capital requirements associated with market entry are barriers to entry for most firms. The amount of sunk cost and government policy also made up this factor. This factor accounts for 7.06 percent of the variance. Traditionally, the telecommunications market has required a tremendous amount of capital, a greater proportion of which is sunk compared to other industries, due to the expenditures involved in the last mile (Miller, 1995; Brock, 1981). Even though there are cost effective alternative technologies such as wireless technologies reducing the market entry costs, new entrants still face huge costs and added risk of sunk investment. Policy constraints such as government licensing requirements are also included in this factor and we estimate that government policy decisions, such as licensing and unbundling rules tends to decisively determine the cost of market entry.

Ford et al. (2005) call the construction of a facilities-based telecommunications network as “technological entry costs” and suggest that technological entry costs are not simply network plant, but consist of any expenditure that is sunk. An economic analysis shows that sunk costs affect entry not only by raising the expected average cost of an entrant relative to that of incumbents but also by their effect on the post-entry unit costs of incumbents (Martin, 2002). In other words, if the extent to which investment is sunk is sufficiently great, then after entry, incumbents will carry excess capacity until it is eliminated by physical depreciation. During this period, the incumbent does not need to gain more capital and the rental cost for capital will be zero. This will lower incumbents’ unit cost, reduce an entrant’s expected profit, and may make entry unprofitable where it would be profitable if investments were not sunk (Martin, 2002).

Differences among the four factors

To see if any of the factors were different in their importance, we compared the means of the four factors. Factor 4 “entry costs” has the highest mean (=5.73), followed by factor 2 “absolute cost advantages” (=5.23), factor 1 “product differentiation” (=4.16), and factor 3, “post-entry profitability” (=4.11) (Table 3). The results indicate that cost requirements of market entry were perceived as the most important barrier to new entrants in the residential broadband market. This result concurs with findings of the previous studies (Ford, et al., 2005; Xiao and Orazem, 2005; Rosston & Wimmer, 2001).

Other barriers to entry not on the list

The survey questionnaire included two open-ended questions asking respondents to describe other barriers not on the list and other obstacles they want to mention. The responses included incumbents' control over essential facilities such as the last mile, capital requirements to enter markets and amount of sunk cost involved in entering a market. Incumbents' superior resources such as human resources and their greater financial capital for lobbying and policy formation were also mentioned by the survey respondents. Several responses indicated lack of access to wide area transport such as tier 1 providers as an additional barrier. Also, recent aggressive pricing by the incumbent telephone companies and government policy were also mentioned in several responses as an obstacle in the competition. Furthermore, the historical advantages of telephone companies, a monopolized network system and low price charged to customers by the incumbent that entrant ISPs could not compete with were cited as the greatest barriers to entry. Other respondents stated, "Technological uncertainty," "very likely dominance of incumbents in the licensed spectrum" and "turbulent and unpredictable federal regulation", which can be driving out investors. The interview analysis reported in the next section further examines these points.

5.5.3 Interview analysis

In addition to the quantitative analysis of the survey data, qualitative information from interviews with executives from broadband access service providers was used to complement to the survey. A majority of interviews, other than the ones where the

respondents refused permission, were recorded using an audio device and transcribed. These interviews with persons who are in a position to make decisions to enter the residential broadband market on behalf of their companies produced the following five themes. Table 5-4 indicates brief information about participants:

- (1) Access to the incumbents' networks: network monopoly and the difficulty of access to the networks
- (2) Incumbent phone companies' predatory retail pricing & overpricing access: lower retail price charged by incumbent phone companies to residential customers than the wholesale price to the leasing ISPs, and overpricing of Incumbent Local Exchange Carriers (ILECs) for leased DSL lines
- (3) Political power of incumbents biasing the regulation and legislation
- (4) Difficulty in access to capital due to regulatory uncertainty
- (5) Financial and technological limitations of alternative access technologies

Table 5-4: Participating interviewees by characteristics

Business type	The Number of interviewees	Rank
CLECs (DSL)	7	President, CEO, vice-president, chairman, carrier division manager, vice president of operator services, senior counsel of government affairs
Land-line based broadband ISPs (DSL & Cable)	4	
Wireless	1	
Incumbent (ILEC)	1	
Total	13	

Access to the incumbents' networks

First, all but one interviewee – significantly the one belonging to an ILEC – mentioned “access to the incumbents' networks” as the biggest barrier to new entrants.

They indicated the unbundled network element (UNE) rules as the reason. The respondents alleged that the current U.S. telecommunications market including residential broadband services continues to display significant monopoly characteristics, and access to the last mile is a difficulty. As is well known, the Telecommunications Act of 1996 encouraged competitive entry by requiring ILECs to open their networks to new entrants. With the UNE rules and the regulated pricing of the leased network elements (under TELRIC),⁶⁵ many CLECs and independent DSL providers had opportunities to enter the market rather easily without investing in their own facilities (South East Telephone, 2007). This may have had the adverse impact of discouraging investments by competitive entrants. Thus, to encourage the investment by both ILECs and CLECs, the FCC eliminated all the UNE rules in 2005 by its Triennial Review Remand Order⁶⁶ right after it eradicated most unbundling requirements for all broadband network operators, such as telephone companies and cable companies in 2004.⁶⁷

However, the problem is the following - the deployment of broadband networks into the individual households requires tremendous amounts of investments, and smaller and independent companies will be driven out of the business because of increasing prices and lack of capital. One interviewee with a big CLEC stated, “When you get to the

⁶⁵ Total Element Long-Run Incremental Cost (TELRIC) rates under Sections 251(c)(3) and 252(d)(1) of the Telecommunication Act of 1996.

⁶⁶ Available at http://www.fcc.gov/wcb/cpd/triennial_review/triennialremand.html

⁶⁷ As indicated in the FCC’s TRRO (2005, Feb.), tracking records of the issue can be found in Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers; Implementation of the Local Competition Provisions of the Telecommunications Act of 1996; Deployment of Wireline Services Offering Advanced Telecommunications Capability, CC Docket Nos. 01-338, 96-98, 98-147, Report and Order and Order on Remand and Further Notice of Proposed Rulemaking, 18 FCC Rcd 16978, 17145, para. 278 (2003) (Triennial Review Order), corrected by Errata, 18 FCC Rcd 19020 (2003) (Triennial Review Order Errata), vacated and remanded in part, affirmed in part, *United States Telecom Ass’n v. FCC*, 359 F.3d 554 (D.C. Cir. 2004) (USTA II) cert. denied, 125 S.Ct. 313, 316, 345 (2004).

end of debates, the issue is the very last mile of facilities. Those facilities, like two individual houses have copper wires...that would never probably be something that would be economical for many carriers to replicate. The issue is not the entire network; the key at the end of debate is the last mile facilities.”

Interestingly, while the FCC keeps emphasizing that its deregulation is aimed at supporting the market economy, one interviewee points out that the FCC’s deregulation ended up deciding the number of competitors in the broadband market rather than letting the market economy decide: the FCC’s deregulation blocks new entrance in the broadband market and reduce the incentives of market entry as well. He stated, “we don’t think competition needs to be mandated, but we don’t think there needs to be unfair advantage either of one party over another when one party had used public moneys, public subsidies, tax dollars, and other subsidies...they had the advantage of building out their networks almost 100 years...a head-start on anybody else on this network build-out. We just want the level playing field. (The government should) get out of the way and let the market decide.” Thus, some companies try to bypass the access difficulty to provide wireless services. One interviewee added, “The amount of money they (incumbent telephone companies) charged has made it impossible for us to compete....that is why we run the wireless because we did not want to try competing head-on, only to finally lose the battle”. Although wireless broadband services can be differentiated from other DSL services in the market, they need to obtain a stable network connection either from ILECs or CLECs to realize the service.

At the very least, most interviewees expressed their fear about the disadvantageous deregulation by the FCC and the increasing difficulty to access to the last mile network. To put it simply, they could not raise enough capital for investments in deploying the residential broadband networks (the last mile facility). The executives of CLECs currently providing the residential broadband access services worry about the increasing price of ILECs' network facilities with one voice. A few interviewees admitted that their companies have already faced increasing prices and one interviewee stated that his/her company stopped providing the residential broadband service a year ago because of low profitability since the policy change. It is presently focusing on the business market.

On the other hand, one interviewee belonging to an incumbent LEC suggested "the vast majority of CLECs failed because they had unrealistic business plans that had no basis in reality" and they could not compete well against the incumbents because they had no ability to provide a triple service,⁶⁸ which was expressed as a killer application in the near future.

Thus, in general, the primary barrier to entry for CLECs is the access to, and pricing of last mile facilities by ILECs. The impact of the Triennial Review Remand Order (TRRO) in Dec. 2004 and certain FCC forbearance orders have diminished the availability of TELRIC priced UNE loops (FCC, 2005, Feb.). Moreover the lack of special access reforms by the FCC continues to enable the ILECs' to overprice DS-1 broadband loops that are a critical component of small business services provided by

⁶⁸ Triple play refers to telecom carriers or cable companies offering a bundle of video, Internet, and phone services. A good example is Verizon's FiOS (fiber-optic services) triple-play offering (Wright, 2006, Nov.23).

CLECs. The interviewees uniformly argued that the government should make sure that there is equal access to the local loop under cost-based pricing on a non-discriminatory basis.

The FCC reports that CLECs reported providing 36% of their end-user switched access lines over their own local loop facilities, 42% by using unbundled network elements (UNEs) they leased from other carriers, and 22% through resale arrangements with unaffiliated carriers. Incumbent LECs reported providing about 22% fewer UNE loops with switching (referred to as the UNE-Platform) to unaffiliated carriers at the end of June 2006 than they reported six months earlier (8.4 million compared to 10.8 million) and about 1% fewer UNE loops without switching (4.4 million compared to 4.5 million) (Table 5-5; FCC (2007b)).

Table 5-5: Reporting competitive local exchange carriers (end-user switched access lines in thousands)

Date	CLECs Reporting	Total End-User Lines	Acquired from Other Carriers		CLEC-Owned	Percent		
			Resold Lines	UNEs ¹	Lines ²	Resold	UNEs	CLEC-Owned
Dec 1999	81	8,194	3,513	1,959	2,723	42.9%	23.9%	33.2%
Jun 2000	78	11,557	4,315	3,201	4,042	37.3	27.7	35.0
Dec 2000	89	14,871	4,114	5,540	5,217	27.7	37.3	35.1
Jun 2001	91	17,275	3,919	7,580	5,776	22.7	43.9	33.4
Dec 2001	94	19,653	4,250	9,332	6,072	21.6	47.5	30.9
Jun 2002	96	21,645	4,478	10,930	6,236	20.7	50.5	28.8
Dec 2002	112	24,864	4,677	13,709	6,479	18.8	55.1	26.1
Jun 2003	125	26,985	4,887	15,728	6,370	18.1	58.3	23.6
Dec 2003	136	29,775	4,842	17,888	7,045	16.3	60.1	23.7
Jun 2004	137	32,034	4,927	19,624	7,483	15.4	61.3	23.4
Dec 2004	149	32,881	5,417	18,961	8,503	16.5	57.7	25.9
Jun 2005	326	33,975	5,826	19,025	9,124	17.1	56.0	26.9
Dec 2005	382	31,388	6,704	14,521	10,163	21.4	46.3	32.4
Jun 2006	399	29,782	6,549	12,546	10,687	22.0	42.1	35.9

Only LECs with at least 10,000 lines in a state were required to report through December 2004. Beginning with the June 2005 data all LECs are required to report. Figures may not add to totals due to rounding. Some data have been revised for June and December 2005.

¹ Includes unbundled network element (UNE) loops leased from an unaffiliated carrier on a stand-alone basis and also UNE loops leased in combination with UNE switching or any other unbundled network element.

² Lines provided over CLEC-owned "last-mile" facilities.

Incumbent phone companies' predatory retail pricing & overpricing access

A total of nine interviewees criticized the so called "predatory pricing" of incumbent telephone companies, such as a \$14.95 per month package for the lowest class

of DSL service.⁶⁹ This is an introductory and promotional pricing plan but the problem is that their low customer pricing hurts competitors' profitability and competitiveness. When CLECs and ISPs have to pay more for the leased networks than the ILECs' retail price, the competitors' business plans in the residential market cannot become sustainable.

On the other hand, as indicated previously, the ILECs' overpricing access and interconnection have been perceived as problematic. Interviewees stated, "Outrageous price for leased DSL lines", "overpricing of ILECs (for leasing networks)" and "the wholesale prices of DSLended up being about 8 times more." In the end, "(incumbent telephone companies) can charge content providers and users more because they can drive up the price...there are no alternatives. The reason there is no alternative is because potential alternatives would have to interconnect with them to connect the customers and contents."

Political power of incumbents biasing the regulation and legislation

All non-incumbent interviewees acknowledged the political power of incumbents resulting in biases in regulation and legislation. "The government should've done a better job enforcing the 1996 Act but they won't do it because the telephone companies have too much money, and are politically powerful. If they have good lawyers, they just don't enforce it." In particular, the ILECs have consolidated to an extent that they create a

⁶⁹ More recently, Verizon started to offer a \$9.99 package for 768kbps broadband service in promotion periods in case of Internet ordering only. This service was perceived among respondents as being possible by the incumbents' economies of scale and previous investment in building the database over a long time.

dominant market power that is hard to be beaten by anyone. One interviewee said, “Another issue is also the very consolidation of the industry proven to be difficult to be handled. Verizon MCI, AT&T SBC Bell South, (they are all) building power houses....some intention of making market agreements, interconnection agreements, more powerful incumbents have much more resources and bargaining power than competitors do.”

Difficulty in access to capital due to regulatory uncertainty

Most of CLEC interviewees mentioned their difficulties in raising capital as a significant barrier to investment. They believe that regulatory uncertainty causes the trouble to raise capital in the market. As a result, lack of necessary capital prevents new entrants from entering the residential broadband market in the first place. One interviewee exemplified the situation by stating, “There is no way that an investor is going to loan millions of dollars, probably billions of dollars to somebody who wants to put in a third wire...investors believe that if you got two competitors dividing the revenue in half, each competitor has enough revenue to cover their costs but if you have three competitors, each only getting one third, that would not be enough to cover the cost.”

This perception is prevalent among respondents as shown in their statements, “The problem we’ve got right now is that there is a conflict in the law and there is a conflict within what is being touted by the FCC out of one side of their mouth, they say, hey we want competition, competition is good for the industry, look what we have

done....Out of the other side of the FCC's mouth, they said that your competition is good but we really don't know how much competition is good." "The best thing for a marketplace is consistency. Regulatory instability hurts more than anything else because when you have inconsistency from legislative and regulatory standpoints, your capital markets retreat because they don't want to infuse the capital into the marketplace in which there is regulatory and legislative uncertainty."

Financial and technological limitations of alternative access technologies

All interviewees including one incumbent company were well aware that alternative access technologies would not be viable competitors in the near future because of their financial and technological limitations. They recognize that the incumbent cable modem and DSL platforms are more cost efficient and technologically superior to other access services, such as wireless and power line platforms. First, wireless broadband currently requires more spectrums to provide services of high enough quality to compete with DSL and cable modems. It was said that, "there are two constraints in wireless that drive up the costs. One is availability of spectrum; you have to have enough frequencies from the FCC. Once you've got the license for frequencies, you have to start to install antennas....As a wireless company adds new customers, each new customer divides the use of frequency and that lowers the capacity that each customer has...if the wireless company gets enough customers and they are sharing the frequency, each customer has broadband service that has capacity that is lower than the broadband service of wired

companies. If you want to provide wireless service with the same quality of service as wired alternatives, those antennas would cost as much as wired networks.” “Wireless could be a competitor in 10 years but not now. Because of quality of service, no dependable carrier-class services without jitter, without interruption in the wireless services...very early phases in the municipal broadband, Wi-Fi and WiMax”

Obtaining the license for spectrum, costs requirements for building up wireless facilities, and technological issues, such as interference, are the most important barriers to entry for new entrants that want to use wireless access technologies because of increasing entry costs. Even though WISPs would not concern very much about the access to the last mile as far as they could get access to either ILECs or CLECs’ fiber optic networks, wireless access still depends on landline networks.

This belief is shared among all respondents as shown in following testimonials, “BPL is not cost-effective, and is more expensive than copper loop leased from ILECs. WiMax and certain wireless technologies are very helpful but those are in progress. Access to these technologies is still expensive. As for wireless access to the customers, you have to have a license, spectrum, and a radio that all cost a lot.” In addition, mesh networks using either WiFi or WiMax were mentioned as limited by the WISP interviewee. “(A mesh network) is viable in certain situations and in some situations, it doesn’t work very well. You can deploy a lot of access points and you can make a really strong signal situation and in narrow areas, the mesh networks work. In a big neighborhood or in trying to cover entire towns and counties, it doesn’t work very well.” WiMax was described as “completely overblown.” “It was designed for licensed users,

carriers, it doesn't handle interference very well...It is set up using licensed spectrum...It's going to be only available to limited parties. Very few operators could afford to deploy it and afford the license."

However, the interviewee from the incumbent LEC suggested putting the matter in a different way, "There are no barriers to entry by access technologies but the alternatives have been limited in that they are not able to provide a triple service. Wireless, its infrastructure could be still very expensive compared to traditional wireline services... One problem with alternative technologies like BPL is that they aren't always capable of triple play." Also, he argued that the government should make a real level-playing field to DSL companies in the triple play market because currently telephone companies "unfairly" have to pay on average 20% more in taxes, fees and surcharges than cable companies.

The government's role in removing the barriers to entry

Ensuring equal access on a non-discriminatory basis

Most interviewees argued that the role of the government should be to ensure open access to the incumbents' last mile facilities including the DSL and fiber network elements. "They should be ensuring that there is unbundled access to facilities of all types at cost based rates. Access to copper, fiber, cellular, and WiMax....including even cable," "No more forbearance of the 1996 Telecom Act provisions by the FCC" and "special access regulation and oversight by the FCC where adequate competition does not

exist to protect retail and wholesale customers of ILEC's," "An equal access to the local loop at cost-based pricing," and "the last mile is still natural monopoly...the government should treat the last mile as a public utility the same way they do surface streets... the last mile should be a separate company. Its only job is to sell capacity to content providers, long-distance, ISPs, wireless providers" were mentioned.

The interviewees do not believe that "there exists sufficiently viable facilities-based competition as announced by the FCC. It was expressed as "a sort of propaganda" held by the government. They also pointed out the risks of a duopoly situation in the residential market. One interviewee argued, "If there are only two competitors, they are able to collude. They won't really compete with each other they would find a way to communicate each other and slow down the process of introducing the new products. They can maximize profits they earn on their own investment and they want to use old investment until it breaks down." "Duopoly never creates price competition. If you want benefits for consumers, you would have more than two providers."

On the other hand, several interviewees argued that the government should have incumbent companies to separate the wired loop facilities from switching and server portion. "The biggest entry barrier is lack of separation between the wired portion of ILECs and switching portion of ILECs....The same price of facilities...wired loop has to be sold separately from switching groups...would be sold at the same price to anybody....we can't get the fair pricing on loops and facilities." "The simplest solution is (I would encourage) functionally separated facilities portions of phone companies from the switching and server providers' portion of ILECs." The interviewee added that

facilities providers would be required to function on a non-discriminatory basis. “they would have to provide non-discriminatory service because they are a monopoly...I hope they provide the same price, same terms to me, that they would to the switching and server providers portion that came from the ILECs.”

Support the rural CLECs by allowing TELRIC pricing

On the other hand, one interviewee whose company is based in a rural area pointed out that if, without the UNE-P rule, rural CLECs were forced to accept the ILECs’ current commercial rate for port pricing, they would be driven out of the business because of an unbearable decline in profit margins, for instance from 20% to 0.9%. The respondent claimed that “before the TRRO of the FCC, there was a 70% margin in the metropolitan areas and a 20% margin in rural areas” (Table 5-6).

Table 5-6: Pre and post TRRO affects on product margins

Description	Urban Markets		Rural Markets	
	Pre 3/2005 (TELRIC)	Post 3/2005	Pre 3/2005 (TELRIC)	Post 3/2005
Unbundled Loop Rate	\$9.64	\$9.64	\$30.59	\$30.59
“Port” Charge	1.70	9.70	1.70	9.70
Universal Service Funds	0.00	0.00	-3.43	-3.43
Total Wholesale Rate for Network Element Combinations	\$11.34	\$19.34	\$28.86	\$36.86
Average Retail Revenues	37.18	37.18	37.18	37.18
Product Margin (Retail Rate Minus Wholesale Rate)*	\$25.84	\$10.45	\$8.32	\$0.32
Gross Product Margin	69%	48%	22%	0.9%

Source) South East Telephone (2007)

He suggests that the disparity in the wholesale platform cost between metropolitan and rural markets not only gives ILECs an unfair advantage, but also negatively impacts rural consumers by creating a barrier to facilities construction by rural

CLECs. In rural areas, with low population density, there is a two fold problem: (1) equipment costs are shared over fewer subscribers and (2) a greater number of co-locations are required to reach subscribers because of low population density (South East Telephone, 2007). Thus, he emphasized that regulations should encourage more CLECs and other technology companies to come into rural areas through the continuing implementation of the TELRIC pricing to the rural CLECs. Then, the companies could have served broadband to a lot more people if they did not have to build equipment on top of their competitors.

A government report (GAO, 2006) confirms that costs for what is known as backhaul are higher for rural areas and can affect the deployment of broadband networks in these areas. Backhaul refers to the transmission of information—or data—from any of a company's aggregation points to an Internet backbone provider that will then transmit that data to any point on the Internet. Internet traffic originating from rural areas may need to travel a long distance to a larger city to connect to a major Internet backbone provider. Because the cost of transmitting over this distance—that is, the backhaul—can be high, backhaul costs are another barrier to deployment in rural areas.

Guarantee the spectrum availability for smaller competitors

One wireless provider stated, “There should be more unlicensed, low cost spectrum for wireless broadband deployment. If we had access to that, then manufacturers will build the equipment, (and) operators (will) come in to fill the gap. But if the government keeps the spectrum at a very high price, large companies would buy the

spectrum, lock it up and at least it is necessary for regulators to come up with a way that big companies have a hard time trying to game the system because for every dime they spend on spectrum auctions, they spend a lot of money to try to figure out how to work the system to their advantages and mess them up for any smaller operators trying to get involved. They want to keep competitors to the minimum. I ask that the spectrum be as open as possible.”

More recently the FCC decided to auction off the 700 MHz wireless spectrum. Soon after, a group of wireless industry entrepreneurs asked the FCC to secure a portion of the spectrum for open access, which will contribute to innovation from entrepreneurs (Caulfield, B., 2007, June 8). Advocates of open access have been concerned that, if incumbent wireless companies were to win the spectrum auctioned by the government (as in most cases historically), the winners would delay the introduction of new services running on the spectrum while continuing to generate cash flow from existing wireless networks (Ozanich, Hsu, & Park, 2004).⁷⁰ Indeed, a consortium of top cable companies and Sprint⁷¹ won 137 licenses from an auction of the Advanced Wireless Services (AWS) spectrum in 2006 but has not moved rapidly to exploit it. Thus, this was criticized as the cable companies’ warehousing strategy that hoards spectrum to blunt competition from possible rivals in providing Internet access (Hearn, 2007, June 18).

⁷⁰ In an analysis of the spectrum auction experiences in the western European countries, Ozanich, et al. (2004) found four trends: “(1) 3-G network development and services have been delayed. (2) Payments to governments by the winning bidders have been delayed, and there have been requests to reduce the final bid amounts. (3) Companies are seeking mergers or network sharing agreements in order to reduce costs and decrease the number of competitors. (4) The delayed roll-out of networks is allowing the incumbent licensees to continue to generate revenues from existing 2-G networks (pp.231-232).”

⁷¹ Cable-operator participants included Comcast, Time Warner Cable, Cox Wireless, and Bright House Networks.

5.6 Discussion and Conclusion

Based on the mean ratings in this survey, the barriers to entry that are perceived as most important by the executives in this study are capital requirements, capital intensity, and the incumbents' control of essential facilities. This result is comparable with that of the previous research, which identified the cost advantages of incumbents as the most critical barrier (Karakaya and Stahl, 1989; 1992). This difference indicates the perceived importance of capital requirements and entry costs in the broadband access service market compared to other consumer and industrial markets. In addition to costs, the magnitude of sunk costs, the incumbents' cost advantages due to economies of scope, the incumbents' market shares, and the incumbents' cost advantages due to economies of scale are all important factors behind the new entrants' decision to enter the broadband market. The identified factors were consistent with those of previous studies (Karakaya, 2002; Karakaya & Stahl, 1989; Porter, 1980) and other telecommunications literature (Ford, et al., 2005; Xiao and Orazem, 2005; Rosston & Wimmer, 2001; Alexander & Feinberg, 2004; Brown & Zimmerman, 2004; Abel & Clements, 2001). In ranking items, most respondents gave the highest marks to the access to the last mile, economies of scale, economies of scope and capital requirements for entering the market compared to other barriers.

The factor analysis resulted in identifying four major latent variables that business executives consider when making market entry decisions. The first factor, "product differentiation," if controlled by incumbent firms, makes it difficult for new entrants to enter the markets. It was found that broadband subscribers tied with a long-term contract

tend to adhere to the previous companies rather than easily jump over to other providers. Thus, heavy advertising by firms already in the market, customer loyalty advantage held by incumbents, brand identification advantage held by incumbents are all directly related to making the subscribers stay preceding choices. The amount of selling expense involved in marketing a product, the incumbent's easier access to distribution channels, incumbents with cost advantages due to learning curves, incumbents with superior production processes and trade secrets held by incumbent firms all contribute to the product differentiation indirectly. However, if new entrants are able to differentiate their product, it can be an advantage to them as well. According to Ford, et al. (2005), product differentiation between intermodal competitors would be stronger than between intramodal competitors. The product differentiation factor in the broadband market explains the biggest variance of the responses in this study.

The second factor, "absolute cost advantages of incumbents" includes incumbents with essential facilities such as the last mile networks, incumbents with cost advantages due to economies of scale, incumbents with cost advantages due to economies of scope, and incumbents with relatively easy access to necessary equipments and supplies (e.g., vertical integration). All of these factors indicate the incumbents' propriety advantages because the incumbents in the broadband market, typically ILECs and local monopoly cable operators, entered the market a hundred year or decades ago, respectively, and deployed the networks system with the government protection. Telephone companies have even been subsidized from the universal service funds. Thus, we can imagine that the asymmetrical cost difference would be extremely difficult to be overcome by new

entrants. Furthermore, when incumbent telecom carriers and cable companies are in the process of transition to delivering triple play services, new entrants with absence of the capability would be disadvantaged in the competition (Belson, 2006, Dec. 10).

The third factor “post-entry profitability” can influence a firm’s entry decision in both positive and negative ways. When the incumbent companies are enjoying high profit margins, this situation may encourage new entrants to desire to enter the market. Also, once new entrants enter a market where the incumbents currently earn high profits, they would expect strong retaliation from the incumbent firms in the form of price reductions, increased promotional expenditures or other means of post-entry strategies (Karakaya, 2002). Rosenberg and Clements (2000) found that an ILEC deters entry by reducing or eliminating the potential competitor’s profit opportunities by forcing high costs.

The fourth factor, “entry costs,” contains capital requirements, capital intensity and sunk costs and government policy. This factor is perceived to be significantly more important than the other factors in deterring market entry. This result seems intuitive because the residential broadband market generally requires lots of capital investment even for the network system, and additional costs to deal with end users, such as extensive customer service and technicians, are prohibitive. As for wireless access providers, an exorbitant price for a spectrum license would be one of the biggest deterring factors.

In addition to the factors identified from the survey data, the in-depth interviews conducted with company executives produced major five themes. The difficulty of access to the networks (the presence of essential facilities), the overpricing of leased lines by the

ILECs to drive up new entrants' costs, the ILECs' predatory pricing to consumers, the political power of incumbents biasing the regulation and legislation, difficulty in access to capital in the presence of regulatory uncertainty, and the financial and technological limitations of alternative access technologies. These results are entirely consistent with the survey results. Most interviewees, whether they belong to CLECs or independent broadband ISPs, have been afraid of the potential negative impacts of the FCC's withdrawal from the open access policies that the commission had previously pursued. The interviewees asked that the government should continue to implement the pro-competition provision of the Telecommunications Act of 1996 in a comprehensive manner and ensure equal access to the ILECs' monopolized networks on a non-discriminatory cost-based pricing. One interviewee indicated that the current deregulatory situation ironically creates an artificial competition and decides the number of competitors rather than let the market decide as Congress intended to in the beginning.

5.7 Limitations and Future Research

Although the executive survey and interviews in this Chapter reveal themselves interesting perceptions and opinions from the marketplace, several inherent limitations should be noted. First, respondents are not neutral observers in the broadband access market. Even though this survey targeted competitive broadband access providers in a residential area regardless their service platforms, the respondents in the survey and interview turned out to come from mostly CLECs and DSL providers. The lack of a comprehensive broadband company list available and the consequential use of the

member list of Comptel, which acts as a CLECs' association group, resulted in this dominance. The respondents have an economic interest in having the government take actions to facilitate their competitive entry and the actions will be advantages to the responding companies. Therefore, their perception of barriers to entry and interview contents should be understood in that light.

Second, this study was based on a small sample of 53 executives from broadband ISPs. Although the number of cases is good enough for detecting the structure statistically, the results may not represent the population. A larger sample size would allow researchers to test differences among broadband service providers with different access technologies. Since the target was company executives mostly of the highest rank, the response rate was not quite high. It was also difficult to make an appointment with them for a phone interview.

Furthermore, this survey failed to incorporate providers with alternative platforms in the analysis. Given that recruitment was on a voluntary basis, we could not obtain survey responses from satellite, BPL and cable modem providers. However, the interviews with 13 executives complemented the survey well because they are currently in the business and have the practical knowledge of the competition level among alternative access technologies and the broad market circumstances. Future studies of this type could attempt to increase the sample size and the number of interviewees. Despite those limitations, this research could identify the major issues affecting market entry of would-be third competitors in the residential broadband access market.

Chapter 6 Conclusion

6.1 Findings of South Korea-U.S. Comparison

Rapidly developing broadband has changed our daily lives by transforming the ways we communicate worldwide. In South Korea, for instance, the rapid adoption of extraordinarily high speed Internet services has made the emergence of key applications possible: online gaming, Internet telephony, e-learning, movies-on-demand, online finance, online shopping, online broadcasting, online chatting-community market and online music. Likewise there is no doubt broadband access will bring forth many new applications while otherwise would not be imagined before. Thus, the key question related to broadband development worldwide has become how to achieve faster, cheaper, universal and high quality broadband access. In particular, the deployment issue in the U.S. has been controversial in light of the FCC's deregulation, a lagging behind theory and delayed entrance of a third competitor in the residential users market.

The purpose of this thesis is, by applying barriers to entry theories, to probe how South Korea was able to introduce stronger competition into the residential market which resulted in more adoption compared to the U.S. market situation. The assumption of this investigation is that barriers to entry are critical industrial factors to deciding the number of competitors and the competition level which will determine the price and quality of Internet access services. By comparing these two countries, we can obtain insights into

which barriers should be addressed either in the market or by the government. 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 prominent 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 also true 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). A union group, Communications Workers of America (CWA), recently produced a report that found an average U.S. broadband speed of 1.9 Mbps. This speed falls behind other nations, for instance, Japan tops the list with 61Mbps followed by South Korea (45 mbps), Finland (45 mbps), Sweden (18 mbps) and Canada (7.6 mbps). CWA claims that the U.S. needs a national broadband policy to "in order to maintain our place in today's global economy - and to create the jobs we need" (Cauley, 2007, June 26).⁷²

Second, in South Korea, reciprocal access to each others' networks is easier than in the U.S. Facilities-based access providers have introduced broadband services on multiple platforms such as DSL, cable and wireless. Even though Korea did not introduce local loop unbundling until 2002, the Korean government abolished major regulations for

⁷² The CWA report is based on input from 80,000 broadband users (less than 5% of respondents used dial-up).

Internet services and lowered the market entry barriers. It also continued to promote market entry by adopting friendly regulation for latecomers rather than incumbents even before the mandated unbundling rules because the government believes that new entrants should be given some incentives to better compete with dominant players (Lau, Kim and Atkin, 2005). Based upon the government's support, new entrants could enter the broadband market with a variety of services and there is more concrete inter-modal and intra-modal competition among providers.

Furthermore, new entrants are also able to take advantage of mandated open access rules. 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 competition forces firms to invest and price aggressively, for fear of falling behind.

Third, more than three providers have always been available to Korean residential users. While the US has insufficient entrance with a third platform, Korea has more than 3 facilities-based providers in a service area. The existence of more than three providers for residential users has not only provided more options to customers but also created more competitive pressure that resulted intense price and quality competition.

Fourth, the Korean government's protection policy makes new entrants face rather low barriers to entry. The Korean government has considered it desirable that at least three competitors should be present 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 even before mandated local loop unbundling.

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 favor policies that encourage the development of alternative broadband technologies and advocate a collaborative governmental role in the building of major broadband infrastructure to speed up the deployment of broadband Internet. It is evident that 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 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. However, empirical evidence from previous literature shows that the barriers vary depending on the scale of entrance, potential local demands, and specific characteristics of the market.

In addition, when entry requires significant sunk costs, the equilibrium market structure will always be relatively concentrated compared to industries where entry does not require substantial set-up costs. Thus, regulation can influence industry structure by

altering the level of sunk entry costs. Unbundling of network elements, for example, reduces the sunk costs of entry by allowing entrants to provide services without duplicating the entire local distribution network of the incumbent monopolists. The impact of unbundling requirements, by reducing sunk entry costs, will be to lower industry concentration (Duvall & Ford, 2001).

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. 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.

6.2 Policy Implications and Concluding Remarks

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.”⁷³ Therefore, the Commission has a statutory duty and an

⁷³ 47 U.S.C. § 257

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, “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” However, this research found that the FCC’s policy direction has been oddly against the responsibility to remove barriers to entry for small businesses.

On the contrary, the FCC has adopted a series of policy decisions that favor the incumbent telephone and cable companies. The government decided that the incentive for the incumbents not to share their networks with competitors would make broadband deployment speed up. New entrants with DSL platforms would face higher barriers to entry such as higher costs and lack of profitability. This may result in a shrinking market share of CLECs and other independent ISPs over time. CLECs and alternative access providers may want to enter most lucrative urban areas and serve the highly profitable commercial subscribers rather than the residential users. The current policy choices of the U.S. also may leave the poor residential subscribers with no options, worsening universal broadband service. To avoid the worst, the government needs to adopt a policy that can give incentives to competitors that leads them to install their own networks and facilities.

A survey and interview conducted in this study indicate that competitors and small access providers have perceived market problems as the following: “the difficulty of access to the networks (the presence of essential facilities), overpricing of ILECs for leased lines, ILECs’ predatory pricing, political power of incumbents biasing the

regulation and legislation, difficulty in access to capital and regulatory uncertainty, and limitations of alternative access technologies both financially and technologically.”

Historically, regulatory policies more favorable towards new entrants and designed to eliminate entry barriers such as open access rules (e.g., unbundling and resale entrance) and subsidy assistance (e.g., universal service support) have increased entrance into the local telecommunications market. Since CLECs tend to provide DSL services together with local telephone service, the number of CLECs indicates the number of broadband competitors in the residential market. Therefore, higher barriers to entry for CLECs imply higher barriers to entry for Internet access service providers that may enter the market by either resale or unbundling the incumbent telephone companies or CLECs. However, 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 3.3% in June 2006 from 5.4% in June 2003 (FCC, 2007, Jan.; FCC, 2003, Dec.).

A study about ISPs (van Gorp, Maitland, & Hanekop, 2006) also reveals the challenges ISPs face and analyzes their response 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 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, which is, in increasing market competition, whether or not independent ISPs will be able to gain enough market shares 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) studied the industry structure of the residential broadband market and argued 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.

Ferguson (2004) defined the U.S. broadband market as a closed monopoly industry and argued that this structure should be transitioned to a largely-unregulated, open-architecture, competitive local broadband system, similar to the computer and IT industry. So, federal policy should create an open-architecture, competitive local broadband system and this system should be governed by an independent body.

Above all, barriers to entry is a very fundamental 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 effectively ruled out most small scale non-facilities based providers. Either DSL lines or cable networks are representative telecommunications networks with substantial sunk costs, and economies of scale and scope. Thus, in the broadband access market, if a new entrant is going to enter 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 broadband over power lines (BPL), 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.

The survey conducted in this research shows that the highest barriers to entry are capital requirements, capital intensity, and incumbents with essential facilities. Also, the amount of sunk cost, incumbents with cost advantages due to economies of scope, magnitude of market share held by incumbents, and incumbents with cost advantages due to economies of scale are all important deciding factors for new entrants to enter the broadband market.

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 with 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, power line 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.

Some commentators from free market think tanks argue that the broadband market is working well because of new emerging broadband access technologies such as fiber and wireless and rapid increases in broadband subscribers and investment (Wallsten, 2007; Cleland, 2007, March 1; Furchtgott-Roth, 2006, Nov. 13). Wallsten (2007) suggests that policies should focus on eliminating barriers to platform competition rather than shaping or directing investment. They argue that the number of high-speed Internet connections is growing quickly, new broadband delivery platforms are emerging, and investment in broadband infrastructure is soaring. There seems to be no problem at all in the status of broadband competition and deployment in the States according to those arguments. It could be. The problem is that they disregard the discrepancy among access technologies and their performance in the market and the monopolistic taking of most subscribers by a few big companies. In fact, the tremendous amount of capital required for deploying network infrastructure makes inevitable the dominance by a few companies.

On the other hand, one of the reasons that the U.S. is increasingly falling further behind other leading countries is “the lack of comprehensive broadband communications deployment plan.” Virtually every other developed country has implemented a national broadband strategy. Americans appear to have a myth that a government leading deployment plan would be another form of regulation and intervention. However, a national broadband vision and plan should not be confused with government dictated intervention into the market. Ironically, free market alone would not be able to achieve its purpose, indefinite competition and resultant universal and quality access.⁷⁴ As seen in the broadband market in the U.S., the pure free market approach easily leads to more concentration and domination by a few companies. Regulators should recognize how much difficult it would be to enter the residential market with only the power of capital despite tremendous competitive advantages the incumbent telephone companies and cable companies have enjoyed for decades through the complete control of the last mile networks. With closed network systems, potential new entrants are afraid of entering the residential market and are electing not to enter. This is so because of post-entry profitability and cost requirements, which would be prohibitive. New entrants often find it difficult to convince investors when they enter residential markets with any access technologies. Even though ISPs could still use the ILECs or CLECs’ networks, the lack of competition thanks to the decreasing number of CLECs would bring more harm than benefits to society.

⁷⁴ As a commentator points out, “the United States made the same mistake in Internet policy that California made in energy policy: it forgot -- or was persuaded by special interests to ignore -- the reality that sometimes you can’t have effective market competition without effective regulation” (Krugman, 2007, July 23).

This study found that increasingly higher barriers to entry to new entrants in xDSL and cable modem are significant. Even though there are available alternative access technologies to new entrants, they are more likely to have high entry barriers in terms of capital requirements and lack of profitability. It was also suggested that wired terrestrial broadband options are technologically more stable and superior than other alternatives. Verizon's investment into FiOS fiber networks indicate that future customers will have to depend more on the incumbents' advanced broadband networks than on having more alternative choices. Thus, at the end, customers will suffer from the lack of competition. The government should encourage third competitors to enter the market on a large scale and introduce incentive systems and make policy decisions based not upon the futuristic theoretical assumptions but on solid and practical market situations.

6.3 Limitations and Suggested Further Studies

Despite the significance of barriers study, some limitations of this thesis should be noted. First, this study premises that the third competitor regardless of facilities should enter the residential broadband access market in the near future even though there is no consensus about the number of ideal market players for perfect competition. Simply lack of post-entry profitability may deter the entry. Based upon an industrial organization approach, however, this thesis assumed that the entrance of a third competitor will ensure stronger competition, and better conduct and performance of market players.

As discussed previously, the reason for this is derived from the observation of the slow entrance of new competitors, the long-lasting duopoly market structure, and the

rather slower market response (i.e., the broadband penetration rate, speed and quality of broadband services) in the U.S. compared to South Korea. However, this might disregard the market demand since the demand of some residential broadband markets may allow for only two competitors to be economically viable. The economic literature suggests that it is very hard to determine how many firms should be allowed in a market in order to eradicate the market power of the incumbents and to achieve market equilibrium (Carlton & Perloff, 2005; Brees, et al., 2004). In particular, lack of data on prices, quantities, product characteristics, and cost structures make it difficult to separate out the demand, technological, and strategic factors determining firms' entry, exit and pricing decisions (Xiao & Orazem, 2005). Thus, future studies should take account of the market demand aspect based upon more sophisticated data.

Second, as indicated earlier, since there is no a cohesive definition of barriers-to-entry among economists and lack of an analytical framework for investigating barriers to entry, this thesis inherits theoretical limitations. For example, the debate on whether or not large scale economies are a barrier to entry has not been settled yet in economics. The dominant definition of a barrier to entry to emerge from the economics literature excludes the economies of scale by following Stigler's definition (McAfee, et al., 2003).

Nevertheless, this thesis borrows an evaluation framework from a previous study which takes economies of scale into account. The logic behind this consideration is that scale economies may be essential to entry because large absolute amounts of capital are required for efficiency. Thus, absolute capital requirements may be so large that relatively few entrants could secure the required capital. Therefore, firms in industries

where the efficient scale is large relative to the market may be able to earn considerable profits without inducing entry (Bain, 1954). In addition, when it comes to the telecommunications network, economies of scale are a critical factor for deciding entry. However, this definition has been criticized as tautological because economies of scale are more likely a result of entry rather than a condition of entry (McAfee, et al., 2003). Thus, the framework this thesis applies could not get away with the lack of theoretical rigorousness.

Third, this study is more likely an exploratory case study based upon a document analysis and empirical investigation. As always, the limitation of methodology should be taken into account before we arrive at any conclusion. Although there is great effort involved to exclude a researcher's bias, the case study is not totally free from the researcher's knowledge and subjectivity. Furthermore, the difficulties of a generalization problem, often overly complex findings, and lack of simplicity have been raised as weaknesses. Since this study employs the comparison of multiple platforms in two countries, the resulting conclusions could be very extensive and complex. Thus, future research should be expanded to embrace a more thorough empirical analysis based upon the findings of this case study. This research could not conduct surveys and interviews in South Korea because of geographic limitations and time constraints. The purpose of this research, however, is to address the current lagging behind issue of the U.S. market situation and lack of market competition by applying barriers to entry. Thus, the main arguments were made over the U.S. situation with the focus more on policy issues. A future study could be expanded to include more countries for an international comparison.

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Appendix A

Survey Questionnaire

Barriers to Entry in the Residential Broadband (High-speed) Access Market Survey Questionnaire

We are interested in learning why potential competitors find it difficult to enter the residential broadband Internet access market. We are asking a number of companies like yours what they think the reasons are. Your answers to the questions below will help us identify the biggest problems. This will suggest which barriers to entry* most need to be addressed, understood and remedied. This is an important policy question, and decision makers need good information on which to base policy choices.

Participating will take only a few minutes of your time. Your participation is entirely voluntary, and all your responses will be treated as strictly confidential. In return for your helping us, we will provide you a copy of the findings of this study when it is completed. Thank you for your participation.

** Barriers to entry are factors that halt or make it difficult for your company as a new entrant to successfully enter the residential high-speed Internet access market in which your company has not previously competed.*

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4	No	[]
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6. Which category represents the best of your company (based on the number of employees)?

Small companies (1-50 employees)	[]	Medium-sized companies (51-200)	[]
Large companies (200-500)	[]	Enterprise-class organizations (500 or more)	[]

7. Regardless of the entrance status of your company in the residential broadband access market, please tell us how important you think the following factors are. On the sliding scale below (1 = not important at all, 7 = very important), please place an “X” at the appropriate place to indicate your ranking for each item.

Each item below describes a separate possible barrier to entry.

Each item below describes a barrier to entry relevant to <u>INCUMBENTS</u> - which refers to companies that already exist in the residential broadband (high-speed Internet) access market before you enter the market. Please select an appropriate place to indicate your ranking for each item.								
		Not important at all			Very important			
		←-----→						
1	Incumbents with essential facilities such as the last mile networks, which may restrict access to new entrants	1	2	3	4	5	6	7
2	Incumbents with excess capacity, which may prevents new entrants from offering their services	1	2	3	4	5	6	7
3	Incumbents with relatively easy access to necessary equipments and supplies (e.g., vertical integration)	1	2	3	4	5	6	7
4	Incumbents with superior production processes	1	2	3	4	5	6	7
5	Incumbents with cost advantages due to economies of scale	1	2	3	4	5	6	7
6	Incumbents with cost advantages due to economies of scope (e.g., tying with video and/or telephone services)	1	2	3	4	5	6	7
7	Incumbents with cost advantages due to learning curves (The more experience, the better cost efficiency)	1	2	3	4	5	6	7
8	Trade secrets held by incumbent firms	1	2	3	4	5	6	7
9	Brand identification advantage held by	1	2	3	4	5	6	7

	incumbents							
10	Incumbent's easier access to distribution channels (e.g., more selling agents)	1	2	3	4	5	6	7
11	Customer loyalty advantage held by incumbents	1	2	3	4	5	6	7
12	Heavy advertising by firms already in the market	1	2	3	4	5	6	7
13	Magnitude of market share held by incumbents	1	2	3	4	5	6	7
14	Expected post-entry reaction of incumbents	1	2	3	4	5	6	7
15	High profit rates earned by incumbents	1	2	3	4	5	6	7
16	Low prices charges by incumbents	1	2	3	4	5	6	7

Each item below describes a barrier to entry relevant to the *MARKET and NEW ENTRANTS* - which refer to companies that intend to enter the residential broadband (high-speed Internet) access market. Please select an appropriate place to indicate your ranking for each item.

		Not important at all \longleftrightarrow Very important						
17	Capital requirements to enter markets	1	2	3	4	5	6	7
18	Capital intensity of the market	1	2	3	4	5	6	7
19	Amount of sunk cost involved in entering a market	1	2	3	4	5	6	7
20	R&D expense involved in entering a market	1	2	3	4	5	6	7
21	Number of firms in a market	1	2	3	4	5	6	7
22	Government policy (e.g., licensing requirements)	1	2	3	4	5	6	7
23	Patent, intellectual property	1	2	3	4	5	6	7
24	Amount of selling expense involved in marketing a product	1	2	3	4	5	6	7
25	Customers' costs associated with switching from one supplier to another	1	2	3	4	5	6	7

8. Please specify other barriers to entry not mentioned above
[]

9. Please indicate other obstacles you want to mention
[]

☺ **Thank you for participating in this survey**

Appendix B

Interview Questionnaire

Date of Interview	
Code Number	

Hello, my name is Eun-A Park.

First of all, thank you so much for your willingness to participate in this interview.

This interview will be used only for research purposes for a dissertation in the College of Communications at Pennsylvania State University.

As you may know, this interview is about barriers to entry in the residential high-speed Internet access service market. This study will eventually benefit the industry by suggesting the government both what barriers exist in the residential broadband access market and what barriers should be taken care of as main concern. You will be asked about 10 questions about entry barriers in the market and other obstacles or difficulty in the market. It won't take more than 30 minutes.

Also, please note that your response will not be individually identifiable, and will be used only for the academic purpose. In addition, your participation in this study is voluntary.

For example, you can choose not to answer certain questions. If you choose not to participate or to withdraw from the interview at any time, there will be no penalty. If you have any questions during the interview, you can always stop me and ask a question.

If you have any questions or concerns about this study later on, you can contact either the principal investigator, Eun-A Park, at (814) 000-0000 and 000@psu.edu, or my

academic advisor, Professor Richard Taylor at (814) 000-0000 and 000@psu.edu.

Also, you can mail any concern to the address as indicated in the invitation email (or post mail). The address is 000 Carnegie Building, Pennsylvania State University, University Park PA 16802. Participants must be 18 years of age or older.

Completion of the interview implies your consent to participate in this research.

I really appreciate your time. Let me start the first question.

1. How long has your company been at your current address?
2. Did your company enter the broadband service access market? When?
3. Do you provide high-speed Internet access service to the residential users?
4. What access technologies has your company used for the broadband service provision?
5. Is there competition in the region where your company provides the service? How much?
6. If your company decided not enter the residential broadband market, why not? What was the deciding factor?
7. What barriers to entry exist in the residential broadband access market?
8. Which barriers are most important to your company?
9. What barriers should be taken care of by the government? What role should the government take to remove barriers to entry?
10. In addition to the barriers you noted, what other obstacles or difficulty exists when your company tries to enter the residential broadband access market?
11. Any other comments?

VITA

Eun-A Park

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Industrial organization model and its application into mass media market
Diffusion of new technologies into communities and their social impact
Informatization Metrics

Recent Academic Works

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