Essays on How Institutions Matter in Value Creation - The Korean Case

by

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Dedicated in loving memory of my late grandmother,

Ho Re Lee,

who lived a truly worthy life.

진정으로 값있는 삶을 살다 가신

사랑하는 이호례 할머니께

본 論文을 獻呈합니다.

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Abstract

This thesis is composed of three independent essays, which explores different aspects how institutions affect value creation. The first essay is titled "Caught in the Downside of Large-Firm Driven Development: Elite Engineers in the Korean Electronics Industry". Where foreign-educated R&D elites choose to work and pursue knowledge creation is a crucial issue in economic development. But the impact on knowledge creation of the organizations that employ such elites is still missing from discussion. The research presented here aims to fill the gap in the literature by addressing the institutional context of powerful organizations as employers of foreign-educated engineering talents, using the case of Korean engineering talents. The findings to be presented in this paper imply that a thriving home-country industry does not always have a positive impact on the best and brightest engineers. Instead, it can have unintentionally detrimental outcomes. This paper also suggests that corporate R&D managers in the Korean electronics sector have yet to develop an effective strategy to utilize extraordinarily gifted professionals. This research will be of interest to policymakers who aim to harness the skills of knowledge elites to upgrade their countries' economies, academics who study institutions' role in economic development, and business managers eager to adopt human-resource policies suited to highly educated R&D personnel.

The second essay, "Multinational Firms, Labor Market Discrimination, and the Capture of Competitive Advantage by Exploiting the Social Divide" is a co-authored work with Professors Jordan Siegel and B.Y. Cheon. The organizational theory of the multinational firm holds that foreignness is a liability, and specifically that lack of embeddedness in host-country social networks is a source of competitive disadvantage; meanwhile the literature on labor market discrimination suggests that exploiting the bigotry of others can be a source of competitive advantage. We seek to turn the former literature somewhat on its head by building on insights from the latter. Specifically, we argue that multinationals wield a particularly significant competitive weapon: as outsiders, they can identify social schisms in host labor markets and exploit them for their own competitive advantage. Using two unique data sets from South Korea, we show that in the 2000s multinationals have derived significant advantage in the form of improved profitability by aggressively hiring an excluded group, women, in the local managerial labor market. Our results are economically meaningful, realistic in size, and robust to the inclusion of firm fixed effects. Multinationals, even those whose home markets discriminate

against women, often show signs of having seen the strategic opportunity. Though the host market is moving toward a new equilibrium freer of discrimination, that movement is relatively slow, presenting a multiyear competitive opportunity for multinationals.

Lastly, the third essay, "Do Institutional Affiliations Matter in Knowledge Creation? Quantifying the Institutional Impact on R&D Professionals", is an attempt to answer the questions raised in the first two essays using quantitative methods. Whereas prior research has shown that foreign-educated knowledge elites are critical to the development of their home economies, little attention has been paid how differing institutional incentives determine the nature and quality of their knowledge creation. This is partly due to the difficulty in compiling reliable data on a large sample of elite engineers' labor market choices and their knowledge creation over time. This study presents a novel empirical design to capture those data and their causal linkages. Combining multiple databases in an unprecedented fashion, we analyze the scientific output of Korean electrical engineering PhDs in relation to their organizational affiliations. As a result, we find strong evidence that the institutions do matter in how elite engineers produce meaningful knowledge.

Dissertation Supervisor: Amy Glasmeier (MIT, Department of Urban Studies and Planning)
Readers: Thomas A. Kochan (MIT Sloan School)
Donald R. Lessard (MIT Sloan School)
Jordan I. Siegel (Harvard Business School)

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I want to praise and give all the glory to the Lord who led me thus far. Personally, God has taught me many things while doing my Ph.D. And it seems to me that the most precious things that I learned are not necessarily included in the thesis. As I look back the past years of my Ph.D. studies, many people who He lovingly placed in my life come to mind.

First of all, it deeply saddens me to think that my late advisor, Alice Amsden is no longer here. Her premature passing caused much personal grief and regret to me. She has guided me over the past years, and her academic influence is unmistakable in everything I have written. I thank God for giving me an advisor like Alice.

I am most grateful for the presence of Jordan Siegel at Harvard Business School, who has been my mentor, co-author and a role model. I often think of Jordan as someone who is cut out for academia, and whose mental keenness, goodwill for students, work ethic and "class" all meld together to form an ideal professor. It has been a joy to work with him and I owe him a great deal in many ways.

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Now I turn to the more personal, non-MIT part. I feel like I can write an additional chapter of the thesis to write about all the people whom I am indebted to and how I feel about them. Although a few lines of thanks here cannot possibly do justice to them, here it goes.

I want to thank my parents for recognizing and encouraging me to make use of my gift. Early on, they realized what my gift is and saw to it that I use it to the full. Although I resisted a lot to their ideas in my adolescent years, I am really thankful to them now as my PhD degree became an important channel of God's blessings in my life. Also, I know that without their unwavering support, it would have been impossible for me to complete the PhD course. Moreover, I am grateful to them for giving me the best present in my life: my sister. Indeed, my sister, Jeansue Hong, deserves a special mention here. She not only led me to Christ, but also motivated to come to Boston. If I didn't miss her so, I would never have even thought of coming to MIT. I am so blessed by God to have a sister like her. Along with my most amazing brother-in-law, Daewon Hong, she loved me and watched over me all throughout my PhD years.

Also, I want to thank my aunt, Rebekah Kim JDSN. All my life, she has strived to offer me the very best, which is God Himself. In all the critical moments of my life, she was there to straighten my path through His words and have warmly embraced me with the love from above. More clearly than anyone I know, she demonstrates to me who God is; and that never fails to touch me and make me want to be so much better than who I am today. Without her and Pastor Paul's faith that led to the founding of Berkland Baptist Church, I really don't know where I would be now (well, one thing for sure - I would not graduating from MIT).

Over the years, Lydia (Hyejin) Han SMN and Pastor Joseph (Byungho) Han have become my spiritual parents in every sense. From the very first day when I came to Boston, I had the incredible

privilege of being a part of International Student Ministry (ISM) under them, where I continuously have feasted on His words and abundant love. I am so proud and thankful to God to have them as my shepherds, whose faiths are truly worthy of imitating. I especially recall numerous moments when Lydia SMN held my hand when I really felt like giving up. With her motherly love and faithful prayers, she strengthened me so that I could go on in faith. Thank you so much, Lydia SMN.

The relationships I have with the sisters in ISM, especially sisters Irene, Shuangqin and Shirley, and my past and present housemates, are very precious to me. When I remember how I am surrounded by so many sisters in Christ who are committed to me unconditionally, I feel very secure and thankful. Also, my "Boston cousins" with whom I share double family ties – both physically and spiritually related – have been a source of constant joy, encouragement and fun.

Lastly, I want to express my gratitude and respect to my late grandmother, Ho Re Lee. She would have been so proud to see me graduate, as my PhD degree is God's faithful answer to her daily 5AM prayers lifted up on my behalf. Her life, which resembled the kernel of wheat that fell to the ground and died (John 12:24), produced many fruits - including that of my own, those of my immediate family and the entire "Lee clan", and furthermore, the precious body of Christ called Berkland Baptist Church. I will always remember her sacrificial love for me, for God and for His people. And as I made up my mind to do so on the day she left for Heaven, I would like to dedicate my thesis to her.

Once again, I want to praise the Lord who is the giver of all good things. I really hope and pray that I can please and bring glory to my God through all He blessed me with. He, the omnipotent God, shall reign forever and ever!

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Chapter I.

Caught in the Downside of Large-Firm Driven Development: Elite Engineers in the Korean Electronics Industry

Even if you have three dozen pearls, they are worthless

until you make a necklace of them.

Korean proverb

1. Introduction

Where foreign-educated R&D elites choose to work and pursue knowledge creation is a crucial issue in economic development. Knowledge, especially the kind that earns the highest economic rents, is tacit and never fully codifiable (Polanyi, 1962), but it is embodied in human minds and moves with them. Thus foreign-educated elites are of interest because, though they are highly likely to remain overseas, they have the potential to contribute greatly to their home economies thanks to their talent and high-quality education. For this reason, their geographic choices are of interest to various disciplines (Bhagwati and Dellalfal, 1973; Rosensweig, 2010; Ramana and Khanna, 2010; Obukova, 2009; Saxenian and Hsu, 2001).

However, the mainstream literature on foreign-educated elites is silent on what happens *after they return home*. Researchers tend to assume that once the home market has lured back its foreign-educated talent, it can automatically and effortlessly benefit from them. In other words, the literature fails to lay out concretely how top talents engage in R&D to maximize their value creation. A notable exception is the work of Saxenian and her colleagues (Saxenian, 2006a, b; Wadhwa et al., 2007), which argues that highly skilled, U.S.-educated Taiwanese engineers who worked in Silicon Valley before returning home

were critical to the development of the electronics industry in Taiwan because they actively utilized their strong ethnic ties and professional networks in Silicon Valley. Their familiarity with both worlds enabled them to replicate Silicon Valley's network of small and agile firms in their home country.

But the impact on knowledge creation of the organizations that employ such elites is still missing from discussion. Knowledge creation does not take place in an institutional vacuum; it is a specific response to the incentives that individuals encounter in their respective workplaces. In other words, individuals' R&D activity is closely tied to the set of incentives externally imposed via their jobs. This paper acknowledges the centrality of employment in value creation. The traditional approach in the economic development literature has seriously underemphasized matching jobs to skill levels. Nevertheless, the key to sustained economic well-being is job creation that can attract and retain top talents. In order to reverse brain drain, it is vital for the home market to have the capacity to lure back its skilled professionals and to persuade them to stay long-term. As Amsden points out, it is "logically flawed and subject to the same error as Say's Law—that 'supply creates its own demand'" to expect employment to rise by simply increasing the stock of human capital (Amsden, 2010: 57). This paper demonstrates that talent utilization—that is, providing suitable employment destinations—is as important as talent creation, if not more important.

The research presented here aims to fill the gap in the literature by addressing the institutional context of powerful organizations as employers of foreign-educated engineering talents. To this end, we analyze a consequential case, namely the electronics industry in South Korea. We tracked Koreans who had received PhDs from the best U.S. universities, and examined their career choices and the degree of control they exercised over their own R&D activities over time. This study sample provides unique advantages for the study of how the institutional context impacts knowledge creation. Upon graduation, Koreans with U.S. PhDs are typically enticed in multiple directions—by academia, by corporate R&D labs, and by entrepreneurial careers in the United States and Korea. The populations that end up in these various destinations are largely comparable in terms of their previous training, capabilities and research potential, but knowledge creation is incentivized vastly differently. Moreover, the boundaries between

the different types of organizations that exemplify different sets of institutional incentives, such as corporate research labs, academia and public research institutes, appear to be rather fluid for top talent. For the 200 PhDs who graduated from the top five U.S. electrical engineering programs and were active on the IEEE database, we found the average number of institutional switches to be 1.64: 70 people switched once between one institutional type and another, and 17 people switched twice[1]. Moreover, this number is likely to be low because organizational affiliation is only revealed when one publishes and because the younger cohort had not been in the job market long enough to make such switches to the full extent[2].

The findings to be presented in this paper imply that a thriving home-country industry does not always have a positive impact on the best and brightest engineers. Instead, it can have unintentionally detrimental outcomes, preventing the top talent from returning to Korea, or, in the worst cases, even prompting them to abandon an engineering career. Though home-country industry development is beneficial for most engineers, it may not hold those who are exceptionally talented. This paper also suggests that corporate R&D managers in the Korean electronics sector have yet to develop an effective strategy to utilize extraordinarily gifted professionals. In-depth interviews were crucial to this study because inferences from placement data are likely to be misleading, especially for the top talents. The nuances of the top engineers' career choices could only be pinpointed via interviews.

This research will be of interest to policymakers who aim to harness the skills of knowledge elites to upgrade their countries' economies, academics who study institutions' role in economic development, and business managers eager to adopt human-resource policies suited to highly educated R&D personnel.

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[1] These observations are based on the careers of the PhDs from 1962 to 2011. "Institutional switch" refers to the career changes occurring between different types of workplaces, such as from a corporate lab to academia. For example, a person who moved from IBM to Texas Instruments (TI) is not considered to have made an institutional switch, but if he became a faculty at MIT instead of going to TI, it would count as one.

[2] For further details of this analysis, refer to Pyun, 2012.

2. The Structure of the Korean Electronics Industry

Institutions have been extensively studied in the past three decades in various disciplines, ranging from sociology, economics and political science. According to the research traditions and specific agendas in each field, the term "institution" has taken on various meanings. However, the students of institutionalism broadly agree that what makes institutions worthy of their research has to do with the following key characteristics. One, institutions encourage and reward certain human behavior over other alternatives, whether consciously and unconsciously; and two, institutional rules are socially constructed and are widely accepted, although they may not be fully rational in terms of technical efficiency.

Some of the most oft-quoted definitions of the institutions are the following. Scott, who famously established the three pillars of institutional theory in his celebrated 1995 work, states that institutions are "comprised of regulative, normative and cultural-cognitive elements that, together with associated activities and resources, provide stability and meaning to social life". (Scott, 1995) March and Olsen (2006) write that an institution means a "relatively enduring collection of rules and organized practices, embedded in structures or meaning and resources that are relatively invariant in the fact of turnover of individuals and relatively resilient to the idiosyncratic preferences and expectations of individuals and changing external circumstances." A prominent economic historian, Douglass North, uses a much simpler definition which is that institutions are the "rules of the game" or "humanly devised constraints that shape human interaction." (North, 1991)

In this paper, we define institutions following the example of Greenwood et al (2008). According to them, institutions are "More-or-less taken-for-granted repetitive social behavior that is underpinned by normative systems and cognitive understandings that give meaning to social exchange and thus enable self-reproducing social order." The specific institutional context of our interest is the electronics industry in Korea. We will investigate, within this context, how relevant organizations are viewed by the elite engineers as (potential) employers and how such perceptions have changed over time. As explained in this section, we believe that the Korean case can help us better understand how institutional context can

influence the career paths and the productivity of elite engineers, due to its rapid, large-business-group oriented development of the industry.

As is well known, the economic development of Korean has been characterized by the dominance of large, family-controlled business groups, or chaebols (Ungson et al., 1997). Unlike the predecessors such as Britain, U.S., or Germany, Korean government successfully transformed its economy through "state entrepreneurism", which utilized the large businesses very effectively (Amsden, 1997). From their inception, chaebols were not allowed to own their own banking system and thus were financially constrained by the government. The government allocated credit to the chaebols and demanded reasonable performance standards in return. And together, they built an enterprise system in Korea that functioned admirably - the average GNP growth in Korean hovered over an impressive 8 percent for nearly three decades, from the 1960s to the 1980s. At the same time, this developmental strategy naturally resulted in a highly concentrated industrial structure for the nation. For example, by the late 1980s, the revenue of the top ten chaebols reached 60 percent of the Korean GNP. Moreover, the revenue of the "big four" – Samsung, LG, Hyundai and Daewoo – put together was a stunning 46 percent of the national GNP.

Although the emergence of the large diversified business groups is commonplace in emerging economies[3], Korean chaebols are unique in their proportional size, clout and diversification into unrelated business areas (Amsden & Hikino, 1994). After becoming globally competitive in mid-tech industries such as steel, shipbuilding, automobiles and consumer electronics, the "big four" chaebols attempted to enter the higher-end of the electronics industry undertaking much risk and learning from abroad (Matthews & Cho, 2000). The huge investments boldly taken on by the chaebol companies paid off in most cases, and Korea now boasts of having some of the largest IT companies in the world[4]. In this sense, this paper is tracing the post-catch-up story of the large businesses as they develop knowledge intensive industry.

[3] For a comprehensive review on this subject, see Khanna (2000).
[4] See Figure 1-3.

Therefore, the case of the electronics industry in Korea offers us unique advantages to study the institutional impact in a couple of ways. First, the electronics industry in Korea has experienced a very rapid development, which had a markedly different impact over the elite engineers over time. This allows us to examine institutional "change" over time. Second, Korean case is unique in that institutions and business organizations have converged due to the massive political, economic and social power of the chaebols. Because of this, it is possible to assess the power of institutions on the elite engineers through observing their responses at the organizational level.

The impact of Korea's industrial development on its electrical engineers is multilayered. Naturally, industrial advancement has helped to reverse the brain drain. In particular, the development of the electronics industry created a large number of jobs for engineers. This phenomenon dramatically transformed Korean engineers' set of career choices over time, especially for non-elite engineers. Even among engineers from top U.S. graduate schools, many have begun to return to Korea to work in the private sector. This section will focus on how successful large-firm-driven development has influenced the locational choices of electrical engineers of Korean origin.

At first glance, there seems to be little reason for worry about the relationship between organizations and elites in the Korean electronics sector. That relationship appears to coincide with the conventional story line that talented foreign-educated professionals could finally find jobs at home thanks to the success of home country development. This scenario creates a virtuous cycle for all parties involved (Figure 1-1) and has already been noticed by several observers. Saxenian asserts that it explains why the Korean community in Silicon Valley is so small compared to other nationalities (Figure 1-2). Although Koreans have earned U.S. PhDs in science and technology in numbers comparable to those of other countries, they were unusual in that they had the option to "return home to secure jobs in large, prestigious companies" [5] (Saxenian, 2006a: 52). An exact return rate for this particular set of individuals is impossible to obtain, but it is logical that the ready availability of engineering careers at home would

[5] Saxenian adds that in the early 1990s, compared to two-thirds of Korean students reported that they would return home, in sharp contrast to the overwhelming numbers of Chinese (94 percent) and Indian (86 percent) PhDs who preferred not to return. There are signs that this pattern has been continuously weakening among Korean students.

distinguish the career paths of Koreans from those of their counterparts from other developing nations (Lee & Saxenian, 2009).

As noted above, Korea has developed its electronics sector via the medium of large organizations, notably business conglomerates (or *chaebols*) that shaped the institutional landscape in the electronics industry. Over the past two decades the performance of Samsung Electronics and LG Electronics in particular has been nothing less than impressive. Virtual non-players in the global market until the late 1980s, the two firms had become respectively the largest and the fourth largest IT companies worldwide by 2010 (Figure 1-3). In 2010, Korea produced 51.5 billion USD worth of semiconductors, the nation's top export item (KBS, 2011). Other organizations linked to the electronics sector are also at the forefront of knowledge creation in Korea. According to the U.S. and Trademark Office, Korea ranked third worldwide in the number of patents awarded in 2009. (Table 1-1) It can be inferred from the top ten Korean assignees of U.S. patents that this trend was strongly driven by the chaebol firms and by ETRI, the Electronics and Telecommunication Research Institute, a public research institute with a history of extensive collaboration with the private sector on breakthrough technologies. (Table 1-2) In addition to generating commercial knowledge, ETRI produces an impressive number of academic articles and was the fourth IT organization in the world to publish a journal indexed by Science Citatation Index (SCI), *ETRI Journal*, inaugurated in 1998.

These large Korean organizations have created a strong domestic demand for electrical engineers. The most pertinent data in support of this assertion would quantify the hiring of PhDs by large organizations, but such data is fragmentary. For instance, Figure 1-4 shows ETRI's extensive job creation. Since its inception in 1985, the number of people employed by ETRI has grown from slightly over 1,100 to nearly 2,000, the majority in research positions. More systematic data is available on R&D personnel at Samsung Electronics, the most significant employer of engineering talent outside of academia in terms of both quantity and quality. Figure 1-5 shows the numbers of people engaged in R&D at Samsung

between 2001 and 2008.[6] As for engineering PhDs in particular, more than 2000 doctorate holders were employed by Samsung Electronics in 2004 (Chun, 2005: 10); two years later, that number surpassed 3000 (Kim, 2006). Currently, approximately 3,600 PhDs work at Samsung, and most have engineering backgrounds. To put this number in context, the number of engineering PhDs at Samsung Electronics is more than ten times larger than the total faculty and staff of all the engineering departments at Seoul National University, the most prestigious university in Korea (SKKU, 2010). The company plans to increase PhD hiring by 20 percent each year; thus there will be 10,000 doctorate holders at the firm by 2013.

The high demand for R&D personnel in Korea is all the more striking when we consider how relatively new it is. Korean organizations' previously limited absorptive capacity left prior generations of engineering elites with extremely restricted career options. For example, before the 1960s graduates of Seoul National University's Communication Engineering department (later the Electrical Engineering department) routinely found jobs at the Ministry of Postal Services for lack of a better option. Though among the most brilliant students at a competitive university, their main job duties were "climbing up the telephone poles, connecting the phone lines and mediating random calls as telephone operators" (Lee, 2004). Only after Goldstar Electronics (now LG Electronics) was established in 1958 did industry begin to create demand for engineers in this field. Samsung Electronics emerged eleven years later, in 1969. Thus it seems reasonable to hypothesize that the Korean economy developed the capacity to absorb electrical engineers, including some of the best, largely thanks to the recent rapid growth of the private sector.

But what takes place after the engineers land their respective jobs remains unclear. Korean companies have been able to attract some gifted engineers, but have they also succeeded in retaining them over the long term? Are they utilizing such talent optimally by providing the right types of jobs? Do

[6] Note that this figure is for all R&D personnel, the majority of whom have bachelor's or master's degrees in science/engineering, rather than PhDs.

Korean engineers view careers in the private sector of their home country as attractive? Why did those who chose *not* to work in corporate R&D in Korea reject that path?

3. Employee or Entrepreneur?

This section will examine whether the presence of successful large companies in the Korean electronics industry has suppressed entrepreneurship by R&D elites. Entrepreneurship has been consistently rare among foreign-educated PhDs over the past 30-some years, particularly in the electronics industry.[7] One possible explanation that can be ruled out is a shortage of suitable elites: there has been a dramatic increase in Koreans with U.S. doctorates in electrical engineering and closely related disciplines (Figure 1-6).

An intriguing piece of evidence about whether large-organization-oriented development has dampened entrepreneurship by Korean elites comes from Wadhwa et al. (2007), who compiled data on the nationalities of founders of U.S. high-tech startups between 1995 and 2005. We singled out Koreans and Taiwanese entrepreneurs, to see whether they tend to enter different industries (Table 1-3). Taiwan is an appropriate point of reference because it resembles Korea in almost all respects except the one that is the focus of our interest: its institutional settings.[8] The Korean–Taiwanese comparison by industry in Table 1-3 shows a Korean dip in semiconductors and a surge in bioscience. Interestingly, this pattern exactly coincides with the strengths and weaknesses of the respective chaebols, supporting the idea that the strong dominance of large companies is related to feeble entrepreneurship in the same industry. There can be two possible explanations. First, it is possible that the chaebols absorb the individuals with potential to found high-tech ventures by offering them attractive jobs, thus indirectly suppressing entrepreneurship. For example, because semiconductors have been the forte of Korean chaebols, demand

[7] The influential Korean entrepreneurs who founded such firms as HanSoft, NHN, AnnLab, Humax, Daum and NcSoft started their companies with college friends in Korea in preference to going abroad to study.
[8] Taiwan is a suitable reference country because it is on a par with Korea in terms of economic development and educational level. But the two countries' industrial structures differ: Taiwan's electronics industry has no dominant players comparable to the Korean chaebols in size and influence.

for engineers with specific knowledge of semiconductors has been particularly high. For Korean electrical engineers, unlike professionals in other industries, the incentive to become entrepreneurs may be substantially weakened if they can easily settle down in large companies. The second possible explanation is that chaebols have directly discouraged high-tech ventures from thriving to maintain their own dominance. Later we will explore which mechanism explains this negative relationship.

Lack of entrepreneurship among top Korean engineering talents has long been acknowledged among Silicon Valley professionals. Observers have been puzzled that practically no Koreans have made it as "stars" in Silicon Valley despite Korea's strength in IT. By contrast, the Taiwanese IT community in this high-tech region boasts numerous renowned entrepreneurs.[9] "There are several thousands of companies on NASDAQ, but I cannot name a single one that grew under Korean leadership," commented the president of Silicon Valley K-Group, the largest association of Korean technology professionals in the Bay Area. "There is even a self-deprecating joke among the Koreans here. We say that there is only one Korean venture firm that had success in the thirty years of Silicon Valley's history, and that company is called Samsung"(Jeong, 2008).

Some may argue that the relationship between chaebol employment and entrepreneurship is not so straightforward. According to a recent survey, one in ten CEOs of KOSDAQ companies (small and medium-sized companies traded on the Korean version of NASDAQ) worked at Samsung before moving to a venture company (Lee, 2009). The same survey reports that 22 percent of all KOSDAQ CEOs had previously worked at the top ten chaebol companies in Korea, and that ex-Samsung-employees-turned-CEOs were mostly in the fields of semiconductors and LCD businesses. This pattern does not necessarily contradict our hypothesis. First of all, the exclusive focus of this paper is U.S.-educated PhD electrical engineers in Korea. Although this pool is sizable and many have become very successful, there is not a single U.S. PhD among the 30 richest venture-based IT executives (Forbes Korea, 2005). Secondly, upon closer examination, we find that the venture CEOs with chaebol experience are in most cases not the

[9] Some notable examples are Jerry Yang of Yahoo, YouTube co-founder and CTO Steve Chen, and Nvidia co-founder and CEO Jensen Huang, one of the 100 highest-paid U.S. CEO in 2008.

actual founders (Lim & Kwak, 2007). Instead, they are scouted by existing venture companies to take on a leadership role after the founding stage, which does not qualify as entrepreneurship.

The dearth of entrepreneurial role models among Koreans with U.S. PhDs contrasts sharply with the plethora of high-profile electrical engineers who have thrived at chaebol companies. These individuals were aggressively sought after by Korean electronics firms for the sophisticated technical knowledge they earned in the United States. A prime example is Dr. Hwang Chang-Gyu (PhD, UMass 1985), under whose leadership Samsung Electronics gave rise to Hwang's Law, which holds that the memory capacity of chips doubles every twelve months (instead of every eighteen months, as previously hypothesized.[10] Dr. Hwang dominated memory development at Samsung from the time the company recruited him in 1989, when he was a post-doctoral fellow at Stanford University. He currently serves as "National CTO" at the Ministry of Knowledge Economy, entrusted with allocating a national R&D budget of $4 billion. Dr. Chin Dae-Je (PhD, Stanford 1983) also had a distinguished research career after Samsung recruited him from IBM's Watson lab in 1985. While running Digital Media Business at Samsung Electronics in 2003, Dr. Chin was appointed secretary of Korea's Ministry of Information and Communication and became the longest serving secretary in the Roh administration. A slightly different case is Dr. Lim Hyung-Gyu (PhD, U. of Florida 1983), whose career exemplifies Samsung's proactive efforts to acquire high-level engineering talent during its phase of rapid catch-up. While working at the company as a non-PhD engineer, Dr. Lim was sent to the United States by Samsung to study non-memory semiconductor technology. He is the first case of a Samsung-sponsored U.S. PhD strategically trained to shore up the company's weak point. After returning to Samsung, Dr. Lim headed System LSI business and eventually became CTO of Samsung Electronics.

Among non-Samsung executives, Dr. Lee Hee-Gook serves as a prominent role model (PhD, Stanford 1980). Starting in 1985 he led the development of 1M ROM technology at LG Semiconductors, initiating the mega-bit era in the memory business. Formerly the CTO of LG Electronics, Dr. Lee is now president of LG Siltron. Another well-known electrical engineering PhD is Dr. Lee Yong-Kyung (PhD,

[10] The earlier version, proposed by the founder of Intel, Gordon Moore, was known as Moore's Law.

UC Berkeley 1975), the first president of Korea Telecom after privatization in 2002. Korea Telecom or KT is a wireless service provider with the largest share of local telephone and high-speed internet business in Korea. The trend for talented engineers with U.S. doctorates to enjoy successful careers at large Korean electronics companies is ongoing. For example, of the 23 vice presidents at Samsung Electronics, 13 were newly appointed in 2010 and among that group nearly half have U.S. engineering PhDs (Kwon, 2010).[11]

It seems reasonable to conclude from the evidence of these individuals' careers that the dominant presence of chaebols and the career opportunities they offer have dampened elite entrepreneurship in the Korean electronics industry. The causal mechanism, however, is not entirely clear. Are elites deciding against entrepreneurship because careers at large electronics firms are simply too attractive, or are they somehow blocked from that path by the chaebols' dominance? Because it is impossible to resolve these questions merely by examining the superficial facts, we sought to answer them by a simple but effective method: asking them directly.

4. Data and Preliminary Analysis

4.1. Overall Study Design

The questions raised in this paper require an in-depth understanding of the perceptions and motivations of the individuals involved. Thus they call for personal interviews. The main pool of interviewees consists of Koreans with PhDs from MIT in electrical engineering and closely related fields. MIT was chosen because its engineering graduate programs are a mecca for top talents. The electrical engineering graduate program at MIT ranks first in the latest *US News and World Report* college rankings, and has consistently ranked first ever since the magazine began publishing university rankings in 1994

[11] The six PhDs are Kim Kwang-Hyun (University of Virginia), Kim Ki-Ho (UT-Austin), Park Dong-Gun (UC Berkeley), Ahn Seung-Ho (University of Illinois, Urbana-Champaign), Yoo In-Kyung (Virginia Tech) and Chung Se-Woong (Colorado-Boulder). Dr. Park is noted for significantly improving the yield rate of memory production while heading Samsung's Manufacturing Center (Kwon, 2010).

(MIT News Office, 2010). Its standing is confirmed by other academic rankings, such as the National Research Council's 1995 rating of U.S. doctoral programs[12]: MIT ranked first among all 274 institutions in the category of overall 'scholarly quality of program faculty' and was named the top school in engineering doctoral programs, surpassing UC Berkeley, Stanford and CalTech (Webster and Skinner, 1996). Electrical engineering has been the institute's flagship research area ever since MIT began to gain worldwide prominence for microwave radar research during World War II (Kevles, 1993).

In light of the institute's excellence, MIT graduates serve as a 'critical case,' to use Patton's terminology (Patton, 1990): a case that can logically be expected to have maximum applicability to all the other cases. MIT PhDs are likely to enjoy more, and more desirable, employment opportunities than other engineering doctorate holders. Their choices will be relatively free of frustration caused by external factors, and jobs that appeal to them are highly likely to be attractive to other PhDs as well. Thus MIT could be considered an 'extreme' case, meriting a close examination because of its far-reaching implications.

This particular group of people is also meaningful for their topical value. MIT PhDs are likely to have the highest potential in value creation and knowledge creation. Koreans are known to be strongly motivated to pursue academic excellence due to the country's Confucian culture and the importance of academic achievements in a meritocratic social system (Sorenson, 1994; Lee & Brinton, 1996). Moreover, electrical engineering has been one of the most popular science and engineering disciplines for over three decades. Thus those who survive the competition and pursue a doctoral degree at the most prestigious institution worldwide can safely be termed as "the best and brightest" of the nation's scientific talent.

[12] The results from 1995 were quoted here because the next NRC ranking was published as late as 2010, and therefore it could not had influenced the interviewees' decisions to come to MIT.

4.2. Data Collection

At MIT, a total of fifty-one individuals were identified who fit the sample criteria for this research. Identifying them was facilitated by the uniqueness of Korean surnames. Koreans have a limited number of family names: 100 surnames account for 99 percent of the population. Thus it was feasible to track the absolute majority of eligible candidates by searching all the possible Romanized versions of Korean surnames on the ProQuest Dissertation & Theses database. This ProQuest search was also filtered by entering "electrical engineering" as the subject name, an approach more likely to identify elite students than entering the names of specific departments.[13] The last step was to determine whether the PhDs thus traced were foreign students from Korea or Korean-Americans. The decision rule employed was whether they had traditional Korean first names. For example, Gil-Dong Hong was categorized as a Korean, born and educated mainly in Korea, and thus included in the final sample. Those with names like John Hong were dropped.

Among the 51 PhDs we identified, 34 agreed to be interviewed (a 67-percent response rate). Overall, graduates from earlier periods were less accessible than the younger cohort, but there was no difference between respondents and non-respondents in terms of career destinations. The most common reason for declining an interview was simply being too busy. A few people were unresponsive to emails and phone calls.

Each interview lasted thirty minutes to one hour; interviews were performed face-to-face when possible and otherwise by telephone. (A couple of participants preferred a written questionnaire to a telephone interview.) After the interviews with MIT PhDs were completed, a supplemental round was conducted using an extended sample from two other top electrical engineering programs, one at a neighboring

[13] This strategy excluded certain individuals who received PhDs from the department that most closely resembles electrical engineering at MIT, and included PhDs from other departments (such as materials science and physics). Considering the multidisciplinary nature of this school, this approach appeared to be more effective than the department-based search.

university and the other at a highly regarded institution on the West Coast.[14] This second set of interviews had a dual purpose. The first was to determine whether the findings from the main sample are applicable to other top schools. The other two schools are largely comparable to MIT in that their doctoral programs in electrical engineering are highly selective and academically renowned, according to the National Research Council and the *US News* graduate-program rankings.[15] Secondly, adding graduates from other schools would better protect the interviewees' privacy. A total of ten additional interviews were conducted with the supplementary pool.

4.3. Preliminary Analysis: Mapping Out Career Paths

Before interviewing the MIT PhDs, we performed a preliminary analysis of their placement data. Their job destinations were available via multiple venues, notably MIT Alumni Association websites like the MIT Infinite Connection and the site of the MIT Club of Korea. Using these two sites, we could identify the employers of approximately three-quarters of the MIT graduates. More aggressive measures were used for the remainder, including contacting them directly, asking their cohorts and searching social-networking websites like LinkedIn and Facebook. Ultimately, we identified the career destinations of all but three participants.

Some intriguing initial patterns were detected in this data. On the surface, the placement data seemed to support the conventional wisdom about how the development of home-country industry creates a virtuous cycle for elite engineers. Figure 7 demonstrates the job destinations of non-returnees and returnees. When the time trend is taken into account (not visible in the figure), there is no visible change over time in the academia-versus-company ratios of non-returnees, as expected.

The interesting part appears in the second circle in Figure 1-7, which represents those who went to work in Korean industry. What we observe here is that a new career path has emerged over the years, namely to work in Korean companies *at a non-executive level.* This recent development stands out most

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[14] The neighboring school's engineering program is quite small; thus personal introductions via acquaintances provided good coverage of Koreans there. For the West Coast school, the author sent emails to PhDs listed on the school websites whose last names indicated Korean origins. A total of ten people were reached this way.
[15] Sources are http://www.seas.harvard.edu/our-school/facts-history/rankings, and http://web.mit.edu/newsoffice/2010/usnews-rankings-0415.html.

sharply when we compare the older and younger generations in circle 2. Among participants about whom we secured complete career information, only two pre-2000 PhDs are currently working for a Korean electronics company. Both took executive positions at LG Electronics after amassing considerable working experience in the United States. The first is Dr. Woo-Hyun Paik (now in his early fifties), CTO at LG Electronics, who moved to LG in 1998 to lead the company's digital TV business. Dr. Woo-Sok Chang (now in his mid-forties) returned to Korea in 2009 to become a vice president at LG Electronics and to head its semiconductor business. By contrast, the rest of the MIT graduates who joined Korean companies are under age thirty-five. They also differ from Drs. Paik and Chang in that they took *non-executive positions,* and did so promptly after receiving their doctorates. The trend of choosing to work at large Korean firms began around the year 2000, and suggests that the electronics industry had finally become an attractive career destination for the top talent. Furthermore, *all* of the younger returnees who took non-executive corporate jobs joined Company A, the company with the best reputation among all institutions in the Korean electronics industry. As expected, there is not a single entrepreneurs in this pool.

Thus the interviews revolved around these individuals' perceptions of Korean electronics companies. This is the case because the sole factor in how elite engineers pursue their careers that underwent a radical transformation over time is the option to work in Korean corporate R&D. Specifically, the questions in the interviews addressed how the existence of such home-country institutions influenced their return decisions, what motivated them to choose certain career paths, what how they perceived working as a non-executive engineer at Korean companies, and whether large-company-oriented development in Korea had impacted their decisions about entrepreneurship.

5. Interview Results

The engineers' opinions about Company A[16] were very consistent across both individuals and schools. The prevailing attitude toward the company can be summarized as "It is a successful company, but it is not an attractive workplace for me." All acknowledged the company's remarkable achievements, to varying degrees, and even expressed pride in them, but they described Company A as far from ideal as an employer when viewed in terms of their ambition, knowledge and satisfaction as professional engineers.

First of all, these elite engineers consider non-executive jobs at Company A a somewhat acceptable option. This is an accomplishment from the company's perspective, in that such jobs were not even on talented engineers' career-choice grid until a couple of decades ago. Interview results suggest that this shift began in the 1990s and was amplified in the 2000s. Consensus among the interviewees was near-universal on one point: if they had to return to Korea and academia was not a realistic or attractive option, Company A was the best alternative. The capability that Company A has built in certain areas is indeed unparalleled. DRAM, or Dynamic Random Access Memory, is one. Company A has retained the global lead in the DRAM industry since 1992; as of the early 2000s, the company had the knowledge and capability to produce over 1,200 types of diversified DRAM chips, unprecedented in the business (Siegel & Chang, 2006). This position of dominance coincided with the era when elite engineers with an industrial bent began to perceive a non-executive position at Company A as a not-altogether-suicidal choice. In fact, a preference for Company A over ETRI has been characteristic of PhDs in the electronics industry, and represents an additional piece of evidence about Company A's extraordinary rise in this regard. It is well known that the majority of Korean PhDs in other fields prefer jobs at a public research institute over corporate R&D. This attitude in turn reflects the fact that in other industries R&D demand

[16] Company A and Company B are two among the electronics firms in Korea that have more than USD 1.5 billion in annual sales and employs more than 20,000 people.

is feeble compared to that of Company A. In other words, no other Korean companies can offer jobs that match the compensation, name value and research environment at Company A. Even compared to the second-best option, LG Electronics, the interviewees' preference for Company A was readily apparent in the interviews.

Nevertheless, a research position at Company A is far from the interviewees' dream job. When asked how they felt about working as researchers at Company A, an absolute majority expressed mild to strong lack of enthusiasm. At best, they regarded working there as a fallback option. Because many had formed these opinions based on first-hand experience or that of close associates, they were very certain in their views. Considering their strong homogeneity in terms of social status and shared professional networks, perhaps it is not surprising that their ideas were highly consistent.

In sum, Company A's current position as a potential employer of elite engineers is a genuine accomplishment, but a seriously limited one. The company could successfully position itself as the top choice in Korea, besides academia, for elite engineers who intend to return. But Company A is still viewed as a less-than-attractive workplace, and the elite engineers were not eager to return to Korea unless they had to. This unwillingness to return appears inconsistent with the fact that top PhDs are actually starting to take jobs there, and with the apparent success of the company's aggressive hiring efforts.

What then are the common features of how elite engineers view Company A? The sections that follow will examine specific aspects of their views in turn, beginning with the positives.

5.1. Positive Features of Elite Engineers' View of Company A

5.1.a. Rapid Technological Advance

The majority of interviewees held highly positive views of Company A's achievements in general. Many even expressed pride in the company and in the overall success of the Korean electronics industry. They gave the company full credit for the rapid technological breakthroughs it has achieved, with occasional hints of admiration. In this respect they differed from those who object to Company A's dominance for

ideological reasons. Some of the PhDs could even pinpoint the exact moment when their opinions of Company A had turned decidedly positive, such as when Company A became the number-one company in the memory business. In the words of one interviewee:

> *I think what is the most important to people like myself is whether we can produce great things or not. So I'd say [my opinion of Company A changed] when Company A became the number one in DRAM. Before then I would have had absolutely no intention of going there, as Company A used to be a no-name company.*

5.1.b. Competitive Pay

Interviewees often mentioned that the compensation package Company A offered was competitive, or at least that the salary would not be a serious disadvantage of working there. Company A's HR personnel assert that pay level is determined by a strict formula that applies across the board to every Company A employee. For example, they say, that they apply a matrix to calculate the salary of a PhD recruited to work as a researcher, and that it will be identical to that of other PhDs regardless of university. The interviews indicate, however, that there is some room for case-by-case variation. Usually the compensation of graduates from top U.S. schools graduates is higher than the formula suggests—if not in terms of actual salary, then in perks like housing subsidies. The interviewees were aware, via their networks and personal experience, of the possibility of such special adjustments. Even without such adjustments, Company A is known to pay the highest average salaries of all R&D institutions in Korea.

A few respondents mentioned that, given Korea's high living costs, Company A salaries might not amount to much after all; others asserted that the high tax rate in the United States would out the U.S. salary advantage. But most considered the pay level to be good, or at least, acceptable. All in all, compensation did not seem to function as a deterrent to working at Company A.

One interviewee who had worked at Company A for ten years, when asked what he considered positive about his experience there, mentioned "good pay" first. He mentioned that he had had to accept a lower

salary when he left Company A, but that his current employer was well known in his field and had good prospects:

> *Well, . . . they do pay you enough. I didn't have complaints about the pay. I made a lot of money when I worked there before. My life was abundant in a materialistic sense.*

5.1.c. The Prospect of Becoming Executives

Though less frequently than other answers, several interviewees asserted that the prime attraction of Korean companies is the prospect of becoming executives. Ironically, this point was made most frequently by engineers working at companies in the United States. As outsiders in mainstream U.S. society, they are acutely aware of glass ceilings at their companies, and of their cultural and linguistic disadvantages. This perspective made it evident to them that those hurdles would disappear if they returned to Korea. Because they have seen Korean acquaintances in the United States being scouted for executive positions by chaebol firms, this is not an improbable scenario. In the MIT circle, for instance, many are aware of Drs. Paik and Chang, who joined LG as executives. This path is a new option for elite engineers that barely existed before Korean companies became globally competitive. Thus it illustrates how the development of a home country's industry can boost the return rate of foreign-educated talents by offering jobs that match their skills and career expectations. In the words of one interviewee who had worked at various U.S. companies, including one of the most prestigious, IBM:

> *When I listen to what people who have been around much longer than I—I mean the people who are in middle management now, and have worked in the US for ten or fifteen years—they say that Korea has its own merits. At that point in their careers, they are overqualified to go back to Korea, and there are not many chances to go up in the US from where they are. [At IBM] there was a very long line of job ranks between a lay employee and CEO. I had nine people between myself and CEO. And for the Korean engineers, it is very, very rare to make it to the level of VP. . . . So those [Koreans at U.S. companies] who worked here for fifteen years or longer, they seem to start questioning whether they made the right decision or not.*

Even as they acknowledge that becoming an executive at a Korean company is an attractive possibility, the elite engineers recognize that the chances of this happening are not high. An appointment as an executive does not depend solely on individual merit; it is often serendipitous, especially for external hires. That is, one's skills and background must match the company's needs, at the right time and at the right level. Given this uncertainty, few actively prepare for such an outcome or expect it to happen:

> *Company A sangmoos[directors] are usually in their early forties. And their expertise has to fit the company exactly. That chance is so small—to be a professional in the area that the company wants to expand in, and to fit all the other conditions, such as age... —to bet your career on that track is too much of a risk.*

5.1.d. Backup Options

The term *backup* arose several times when elite engineers were asked to describe what Company A signified to them. It aptly expresses the sense of security provided by having a last resort if all else fails. Especially when comparing themselves to students from other developing countries, the Korean PhDs readily admitted the desirability of having at least some.R&D job opportunities in their home country. Thanks to the aggressive outreach efforts of large Korean companies, furthermore, securing an R&D position back in Korea even entailed minimal search costs. This point is adequately expressed by a recent PhD:

> *It's good to have a backup option. Companies here in the US, they don't go that far. They do make some efforts to reach out, but they would not treat us as VIPs. They might probably give out free T-shirts, and that's about it.*

Generally speaking, the interviewees viewed having the option of a Company A job in Korea as a positive thing. In only one case did the idea of backup have a negative connotation, and this interviewee was discussing the impact on society at large rather than the well-being of individuals. His point was that

having such an option diverted top engineering talent from other career paths that entail higher risk but may result in more radical knowledge creation:

Yes, people here are spoiled in that sense. They think, "Oh, great, I have some insurance in life."

5.1.e. The Best that Korea Can Offer

As noted in section 4.3, the top PhDs in electrical engineering are unique compared to the PhDs in other fields in that they tend to take jobs in corporate R&D labs rather than public research institutes. The interviews revealed that this pattern prevails because they prefer the types of jobs offered by the private sector. None of the interviewees responded otherwise. This pattern in turn reflects Company A's status as a potential employer even in the minds of the top talents, especially those without a strong academic bent. When asked why this was the case, people responded that they liked either the nature of research in the private sector or the company's promotion system. When asked to compare engineering careers at Company A to those at public research institutes, these two interviewees and others replied that they envisioned a much more exciting future at Company A even with all its limitations:

Public research institutes in this field are not exciting. . . . They don't conduct any really great research, nor do they do really fast-paced commercialization. It's stuck in the middle. What they are doing is the stuff either academia or industry can do but chose not to do.

But [for people like me] the perception is that you will go to either academia or companies if you go back to Korea. Public research institutes are not as attractive.

A few interviewees even mentioned active knowledge creation as one of Company A's advantages over other institutions. This view is counterintuitive because the priority of corporate R&D is profit maximization rather than producing meaningful and exciting research from the researchers' perspective. In the words of one PhD:

For one thing, when I was in the IBM research center, I knew where the good papers were coming out. Company A has consistently published good papers in the area of process design.

The level of research is higher there [than at public research institutes]. . . . If you are thinking about your career prospects, you want to belong to the mainstream.

When the interviewees were asked to compare Company A and Company B as potential employers, it became clear that Company A enjoys supremacy in their eyes not only over public research institutes but also over other companies in the Korean job market. The respondents generally remarked that Company A was on a different level from Company B, which is commonly considered the second-best choice. Some qualified their statements, noting differences between different research areas, but no one expressed a preference for Company B over Company A, ceteris paribus. Few interviewees hesitated to distinguish between Company A and Company B. As a PhD from Stanford put it:

Company B . . . *I am not sure, but I don't think there are PhDs from the top U.S. schools in* Company B *[who take non-executive R&D jobs upon graduation]. People actually don't know about* Company B*'s job openings, or even consider going there as a possibility at all.*

In sum, PhDs from top U.S. universities agreed that a career at Company A is the best that Korea can offer them outside of academia. What is lacking at Company A, they believe, will also be found wanting at other institutions in Korea. This sentiment was well expressed by one interviewee who had worked at Company A for several years:

But still, we can all say this because it's Company A. Company A gets called a lot of dirty names, but there are no other companies in Korea that are better. For example, they would give you overtime pay. . . . What other [Korean] companies would treat you that way? So that's why people go there while they have all these complaints. At least you know that you can make a living for yourself and your family.

5.2. Negatives Features of Elite Engineers' View of Company A

5.2.a. Working Culture

The long working hours at Company A are quite notorious. About half the interviewees expressed misgivings about work-life balance at Company A, especially in light of the alternative of

working at U.S. companies, which allow time off, in the words of one interviewee, to "grill barbeques in your backyard on the weekends." If only a handful of respondents had expressed such misgivings, we might attribute them to mere personal preference. But the long hours at Company A were repeatedly attributed to inefficiency within the organization. These highly motivated and hardworking individuals affirmed that they did not resent long hours per se if the situation merited extra effort. They were certain, however, that this would not be the case at Company A. Instead, they expected (and some had experienced) extreme inefficiency at the organizational level that could not be changed by a mere non-executive researcher. The prospect of systematic inefficiency over which they would have no control discouraged many, particularly because inefficiency is at odds with their practical orientation as engineers. Some also speculated that an authoritarian and hierarchical strain in Korean culture contributes further to rigidity at Company A.

> *My friends who went to Company A, they joke that it feels like a week is Monday-Tuesday-Wednesday-Thursday-Thursday-Thursday.*

One PhD who left Company A cited this aspect of company culture as the most serious shortcoming of his experience with the company:

> *It's more about that I cannot exercise my full capacity. . . . The culture is not meritocratic, people have to stay in the office for a long time, have to work after hours, and you are always being judged according to your loyalty. Even though I do a great job on certain tasks, I don't get recognition. They don't accept my suggestions. . . . There are not many competent senior engineers in the company, like those who are called "masters" in Intel. All those things lead to frustration.*

5.2.b. Job-Skill Mismatch (Recruiting System)

Many people who had worked at Company A described frustration at their inability to do meaningful work. A number of interviewees had arrived at the extreme conclusion that the company does not really need people like them. They also believed that underutilization of their talents was a systematic

problem. Some even traced the problem to the company's nature, which had led to success in the past and which they therefore expected to persist for a long time. One interviewee made this point a very specific way:

> *Yes, Hanyang University grads, Korea University grads, SKK university grads [all second-tier Korean universities], . . . there are a lot of those people [at the firm]. But Company A doesn't really like people like us, who are from KAIST and SNU [top-tier Korean universities]. Among my high-school friends [at an elite science magnet school], many went to Company A but no one is there now. They all became medical doctors and lawyers. Company A, in fact . . . smart people work there for a few years after getting a master's degree, and then they quit.*

Interviewees with substantial industry experience in Korea who had subsequently gone elsewhere gave more detailed personal accounts like these two:

> *This is my personal conclusion: they don't need super-smart people. Rather than someone who is really smart, the type of people they need is those who can faithfully and repeatedly carry out same tasks that are not so difficult. Those who are really smart and do things in bigger scales, they cannot remain in the company for very long. The essence of the work there, . . . it is not high-tech, but something that is very incremental. The ideas are not that important, but to work long hours is. And they cannot help it because it is a manufacturing company. The organization is optimized in the way that fits what it does. It was just not the place for me.*
>
> *In Company A, it is difficult to display personal potential. The organization is too strong there. You have to be a part of the system to survive. Top-class people may not fit in there. They cannot blossom.*

The inconsistent aspect of this picture is Company A's zealous efforts to recruit this very group of people. Company A is well known for its recruitment of Korean students at top U.S. schools via high-profile recruiting events, expensive gifts, restaurant meals, active sponsorship of events organized by the Korean Graduate Student Association, and meticulous maintenance of personal relationships with target recruits. All the interviewees in the sample had been subject to such aggressive hiring efforts, and thus

they knew that Company A would always welcome them with open arms if they were willing to join the company.

Why does the company try so hard to recruit elite engineers if it does not really need them? A few interviewees attributed this apparent irony to Company A's culture: the company initially recruits widely and then makes people compete internally. Thus it is rational for the company to recruit aggressively and retain only those who prove themselves in the end, but it would be irrational for an individual to take a job there.

> *Company A is all about recruiting all the quasi-elites and smarter-than-average people. And let them compete within the organization; cut them out after watching their performance. . . . In the U.S., although you are an MIT graduate and all, it's not easy to get a job in a good company or a research institute. Even when the economy is good, they don't aggressively recruit like Company A would. . . . From the perspective of a job seeker, if you have a PhD and if you care about your research at all, you would naturally want to have a good job-skill match when you are getting a job. Those places will be difficult to get in but would support you well later on, unlike Company A.*

An alternative explanation suggested by several people has to do with how HR departments at Korean companies handle hiring. Without exception, respondents who had had job interviews at Company A and at U.S. companies all noted that the hiring of non-executive engineers is handled mainly by the HR department at Company A but by individual research teams at U.S. companies. HR personnel naturally lack detailed knowledge of engineers' backgrounds and skills, and they are reportedly compensated on the basis of how many top-school graduates they attract to the company. This scenario results in intense recruitment efforts but little scrutiny of individuals' capacities and placement once they enter the company. Thus the company's hiring campaigns are characterized by systematic inappropriateness and tend to result in suboptimal job-skill match. Elite job seekers feel in the dark about how their unique hard-won knowledge would coincide with that of the company, and they are left with the impression that the company is indifferent to this question, as these two interviewees indicate:

They [Company A recruiters] separate out EE students and buy us dinner. And they always tell us that they would like to hire "all the people who are sitting here." At least until now, it is not a problem at all to get a position at Company A if you graduated from MIT with an EE degree. But when I really think about it, it's kind of funny. Reflecting on my experiences on getting a job in the U.S., . . . even the companies that are much smaller and less in quality compared to Company A, they do really thorough interviews. They really check it out if one would fit in well with the company or not. In contrast, Company A would just be open arms if we turn in our applications. I cannot get rid of that impression. In my opinion, it is a bad thing.

The recruiters [from Company A], from their perspective, they just have to bring people in. They want to network. And the communication between HR and the R&D department seems to be not good. . . . In the U.S., the contact person is usually the manager of the team where you are going to work if you get hired. Although HR may start the process, eventually they will direct you to the team. It will lead to better job-skill matching. So the way I see it is that Korean companies are all about just hiring people first, and they don't care about how they will continue to build up their careers.

This suspicion was confirmed by an interviewee who worked at Company A for almost ten years and participated in the hiring of his team members. Himself a PhD from a top U.S. schools who joined Company A after receiving his doctorate, he is no longer with the company. Thanks to first-hand experience, he could describe in detail the hiring of foreign-educated PhDs like himself:

First of all, there is a problem in the hiring process. The job offer from Company A comes from the HR department. From the research department, say I am working there as a manager and want to hire so-and-so. In this situation, in Company A, the information on individual compensation cannot be disclosed. It is their principle. So say I want to hire this guy at this level but I want to pay extra bucks to lure him. But HR cannot tell me directly how much they can pay him. That is negotiated between the potential candidate and HR. HR can only ask me something like, this guy is being picky, so how much do I want him? And the compensation information can

be only seen by the executive level, not at the managerial level like me. So I have to go to the executives to work out the offer. All of this makes the communication really difficult. Plus you have to be really discreet when you talk to old people in Korea. But in the U.S., the offer is handed out at the team level. So the companies here allocate budget to each department; each can just take care of its needs with the money that is given. In Korea, we do have the form of departments, but the departmental budget is calculated without the labor cost. The labor cost is later added by the HR department. As people are not using their own money, when they see smart people they would just sweep them in. It all boils down to money. If it's their own money and they have to be responsible for it all the way, they would be really careful in spending it. Even though someone has a MIT degree, if they are not useful to them, they would not hire such people.

5.2.c. A Dead End for Engineers

In Korea, if you fail at Company A, you really don't have any other places to go. If you get fired, that's the end of the story. Really, you should just start a fried-chicken franchise; that's about the only thing you can do at that age.

Nearly all the interviewees shared the serious misgiving that a career at Company A was a dead end. They offered two explanations. First, if a Company A job did not work out, they would be left with no other options. Because Company A is so successful, it monopolizes all the talent, resources and prestige in the R&D arena in Korea. This circumstance leaves elite engineers with no alternatives in the electronics industry. Given the prevailing highly concentrated industry structure, small and medium-sized enterprises (SMEs) [38] cannot, and do not need to, employ top-flight engineers. As noted in section 5.1.E, this particular group of engineers perceives even second-best Company B as not on par with Company A, let alone the SMEs. Among those elite engineers determined never to pursue a full-time job at Company A, the risk of being stuck there with no good alternatives was often the most important reason. One PhD who chose to work at a middle-sized U.S. company explained his conviction that he had made the right decision:

What really is different [from the United States] in Korea is that there are no quality mid-size firms there. If you compare Company A and SMEs outside of Seoul, the levels between the two are just too different. In the US, it's not the case. For example, the company I interned [at] in the U.S. was not a very large one in terms of physical size, but the level of research, the caliber and qualifications of the other employees, their intellectual capabilities, . . . those were by no means inferior to other well-known big firms. But in Korea, besides the large players, what alternative is there? Nothing. So here, I feel like I have a lot of options. But in Korea, if Company A goes out of business, there's only Company B *left. Then, if* Company B *flops too, where would you go?*

Unlike at U.S. companies, furthermore, Korean companies offer no career paths that allow engineers to spend their entire careers in engineering. With seniority, engineers at the chaebol companies are assigned more and more managerial duties instead of more challenging engineering tasks, regardless of their preference. When Company A engineers approach their late forties, therefore, they find themselves either promoted to the executive level or forced to leave the company. Graduates of the most prestigious schools do have a better-than-average chance of becoming executives, but even this outcome is far from guaranteed. Meanwhile, the interviewees perceive more flexibility at U.S. companies: when they look around in the United States, they see engineers in their fifties and sixties who are practicing their profession. In general, the boundary between the managerial and engineering tracks is less rigid in the United States, making it easier to switch back and forth. Especially for those who are fond of engineering, this is a significant drawback of working in Korea:

There are so few of them [places to work in Korea], like Company A and Company B. If you don't fit into one of those companies, you cannot move to other companies in the same industry. There can be legal issues as well, because they are competitors. . . . If you go to work in industry, you have to be prepared for being fired around when you are in your late forties and early fifties. Company A is the best company in its own right, but you cannot continue to work there if you don't get promoted from bujang[middle management] level to executive level. That does not just depend on your personal merit, but also on luck and human network. And the chances of being

promoted to become executives are pretty small. That's too much risk to bear. . . . Although you can hold out until your late forties, that's probably about it. This is a source of great stress for the engineers in Korea, in the society where living up to a hundred years became the norm. Meanwhile, in the U.S., you can remain as an engineer although you get old. And there's a way to come back from management track to engineering track. You can live as an engineer for your lifetime.

5.3. Company A and Entrepreneurship

Here we will turn to the question of whether and how a chaebol-oriented industry structure has suppressed the entrepreneurial potential of the most talented individuals. Despite the popular stereotype that Korean elites are not very entrepreneurial, around two-thirds of the interviewees responded positively when asked whether they had considered becoming entrepreneurs. Half had considered the idea quite seriously at least once in their lives, and a few were determined to pursue entrepreneurship in the near future but not in Korea. Again, this pattern demonstrates the critical role of institutional design in value creation.

The respondents unanimously pointed to the excessively domineering presence of large firms as the main hindrance to entrepreneurship in Korea. There were three strands to their reasoning. First, SMEs in Korea rely too much on the chaebols, often to the point of being controlled by them. In Korea's current economic system, final producers are entitled to take the majority of the profits. This arrangement leaves the SMEs at the mercy of the chaebols, because the majority of SMEs produce intermediate products. The elite engineers, aware of this structure, naturally refrain from founding startups in Korea, as these two interviewees demonstrate:

I was really interested in doing venture in the period after college in Korea and before I came to the States. . . . However, after working in a Korean venture company, I realized I can't do venture in Korea. I have to go to a large company. It's hard to survive for venture companies. In Taiwan, things would be different—Taiwan venture firms have nobody who bullies them.

When I look at Company A and Company B, . . . the truth is that they are ruthless. . . . It's not the presence of the large companies per se that matters, but that there is just no chance that venture companies can do well because of the large ones [in Korea]. As far as I know, SMEs have to deal with large firms a lot, and those large firms are quite tyrannical. . . . So I am not sure [about starting a venture company in Korea].

Second, the elite engineers were skeptical that the large firms would be willing to nurture ideas they consider radical. They predicted that chaebols that encountered such ideas might choose to suppress them altogether, both within and outside their boundaries. For example, the interviewees thought that chaebols that come across relevant new ideas at technological start-ups would simply choose to freeze out the competition. This practice differs from how start-ups are typically treated in the United States, where established firms are much more willing to pay for promising ideas by buying start-ups. Some interviewees added that the chaebols are likely to ignore new ideas, even when those ideas arise within their own boundaries. Among those who were serious about entrepreneurship, a few had considered working within the existing chaebol system. That is, they had envisioned bringing creative ideas to the chaebol firms in order to draw on the abundant resources that chaebols possess to bring such ideas to fruition. At one point or another, however, those with such ambitions concluded that this model would not work. For one thing, they strongly doubted that the chaebols would offer them a fair share. The interviewees also feared that the chaebols might shut down radical ideas if they turned out not to lend themselves to earning short-term profits. Whether or not these claims are justified, they represent elite engineers' perceptions of how chaebols would act:

In Korea, my area is actually a field where a few venture companies should have emerged by now. But if there's any movement towards such direction, Company A just buys out everything. I don't know how it senses those activities so quickly and deals with them. . . . In my area, Company A hasn't been making a move at all until very recently. But around a year ago, when some promising signs of a novel technology started to materialize, Company A just devoured everything. I heard it is investing aggressively in the new technology now. So I have this Korean

friend who is from the same PhD program, and he is also working on the same topic as I. We had a chance to chat recently, and talked about how it will be great if we bring to Korea what we are working on here. But my friend said that if Company A thinks of this, then the game's over. That was our conclusion.

One interviewee who was about to launch a U.S. company to build on his academic research remarked that the experience of starting a firm in the United States contrasts sharply with what it would have been in Korea. In the United States his original ideas were greeted with enthusiasm and almost effortlessly won active support, but in Korea he could not persuade companies to listen to his ideas even when he offered to explain. Thus, though he would have preferred to go back to Korea, he ended up staying in the United States. His frustration at the rigidity and shortsightedness of the Korean company he spoke to was palpable:

Recently I had a phone interview with one of the chaebols, because they were so persistent about the interview. I told them everything—I have this item which will lead to a venture company here in the U.S. The Korean company responded that it sounded fine, but the company was interested in my experience in a different area. This knowledge is actually not that special. Basically anybody who has the right training can do what the company wanted. So I asked the company if there's any possibility for me to take this original item to Korea and start a venture company under its roof. I offered the idea to the firm so that it can concentrate on commercializing the product; I really wanted to pursue this item. And the reply from the company was that "We don't think that will happen." When I heard this, I felt the potential of my idea—which is big enough to create a one-man company—was crushed by the bureaucracy of the chaebol.

Third, a lack of role models in Korea discourages elite foreign-educated engineers from pursuing the entrepreneurial path. Though Korea has produced a sizable pool of talented engineers, none of the interviewees could name a single person in their field who had become a "star" entrepreneur in Korea. Meanwhile the success of Company A standouts like Dr. Hwang Chung-gyu was common knowledge. This shortage of entrepreneurial role models discourages entrepreneurship by the engineering PhDs by

increasing information costs and lowering the social prestige attached to the entrepreneurial role. An additional factor that aggravates this trend is the structure of venture finance in Korea, which puts the founder's personal fortune at risk if the company fails. Such a failure would also stigmatize the founders, disadvantaging them in their subsequent careers. Most of the PhDs would find such an outcome extremely difficult to accept, especially because they are accustomed to being high achievers, as these two interviewees made clear:

> *A few years ago, some of the people I know in Korea who had a good idea attempted to do a start-up. So they tried to raise funds. They said some financiers were not shy to tell them things like this: "If my son is doing what you are doing, I will break his leg." It was incredibly hard for them to get funding. And if they failed, it will be difficult for them to move to other good companies later on. Here in the U.S., people think those experiences are valuable. But in Korea that is not the case, really. It's the culture. They do not value it at all.*
>
> *I am personally not interested in entrepreneurship, but I have friends in Korea who are. I think they will be better off if they start a company in the U.S. Here, even if you fail, you can start over. You are not considered as a loser.*

One interviewee followed up his interview with an email message elaborating his thoughts on barriers to entrepreneurship in Korea. He was well acquainted with the question, having seen several fellow labmates from graduate school start firms, and having himself worked for a U.S. technological start-up. His message summarizes well what other interviewees expressed fragmentarily:

> *The reason why venture company model can't work in Korea is because the large companies who have the financial resources are not willing to buy the companies at proper prices, but they are accustomed to steal novel technology, or give them indirect pressure and destroy them. To be frank, this is a faster, easier and "cheaper" way to deal with them. So two things: there is this bully in the neighborhood, and also the underlying institution, social norms, and legal system are not in place. . . . In the U.S., numerous companies are bought and sold continuously, but I rarely hear about a Korean large company buying a small technology startup at a fair price. How Dr.*

Ahn's company [he is refuerring to AhnLab, one of the most respected and successful venture companies in Korea, which specializes in computer vaccines] could survive has to do with it being a software company. Chaebols are not interested in that. If there was a chaebol acting greedily, chances are that the founder wouldn't get proper compensation and will be deprived of all he has done. Everybody understands this, and it's why they don't do venture. There were two venture firms in the same area, solar battery, in the U.S. and in Korea. I know both cases well. The U.S. venture focused on selling the company upon sufficiently developing the technology. But the Korean one,founded by SNU graduates, thought they should build a manufacturing facility soon, in order to survive—because they cannot, otherwise. Maybe there's no one right answer to which model is better, but at the very least I can say it's a pity that there's one significant path blocked in Korea.

The "blocked" path mentioned here may refer to a career of the type exemplified by Dr. Zhonghan Deng in China. Dr. Deng, a PhD from U.C. Berkeley and one of China's most prominent and influential entrepreneurs, is the founder of Vimicro Electronics Corporation, which specializes in the design and development of mixed-signal semiconductor products. In little more than a decade, Vimicro has become a company with a market capitalization of $56.6 million. Dr. Deng, who worked at IBM and in Silicon Valley after his doctoral studies, returned to China in 1999 with four U.S.-trained Chinese colleagues to start Vimicro. Because Dr. Deng clearly would have had a promising future in the United States, his decision to return to China caused a sensation in the Bay Area at the time. He was nevertheless strongly motivated to go back, precisely because he saw "a lot of room" in the industry:

I'd seen that on the one hand China was developing very fast, while on the other hand there was still a great shortfall in the development of core technology and integrated circuits here. There was a lot of room for us professionals to cooperate or collaborate. It was under these conditions that Vimicro was established[17].

[17] Those statements are directly quoted from an interview with CCTV. Retrievable from http://www.cctv.com/lm/124/41/90129.html.

In this section, we discussed how the presence of very successful and dominant companies may lessen entrepreneurship by the elite engineers in the same industry through various channels, which can be termed as chaebols "crowding out" ventures. Although it is difficult to prove precisely how much the claims of the interviewees are true, evidences suggest that the crowding out is taking place among at least some of the most gifted group of Korean engineers[18].

6. Analysis

The interviewees followed a handful of identifiable career paths that reflect both the constraints and the opportunities presented by development in Korea. The four paths we will examine account for all the PhDs who were interviewed except those with a very strong academic bent[19] and an outlier case to be described in section 7. As expected, the rise of industry in Korea has shaped the careers of its foreign-educated elites. What is surprising is the *adverse* effect of home-country development on elite engineers' decisions about returning and about knowledge creation. Even Korea's globally competitive top company has (inadvertently) discouraged talented people from undertaking the most exciting, risky and radical kind of knowledge creation. In other words, its behavior actually *prevented* them from working for Korean industry. This pattern even characterized those who ultimately aimed at an executive position in Korea, because it required them to build careers in the United States before seeking a position in Korea. The overarching presence of the chaebols was detrimental to entrepreneurial activities as well, and led a number of interviewees to abandon an engineering career altogether.

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[18] Through constructing counterfactuals of "what if these elite engineers became entrepreneurs", attempts to estimate the size of the financial loss that has occurred due to the aforementioned industrial structure in Korea in future research.

[19] These people said that they would not consider any option other than academia and did not have a return obligation; they represented about 20 percent of the sample. Their choices did not differ much from those of the non-academic interviewees in that the majority of them said that they would work in corporate or public research institutes in the United States until they could secure academic appointments.

The first path is that of elite engineers who were forced to return to Korea and ended up at Company A because it was the best choice available to them. Before going into the details, a brief explanation will be given on what this obligation is. There are two types of such obligations, which applied to several PhDs in the interview pool. First, there were a couple of people whose PhD studies were financially supported by the Korean companies and therefore had to return to the company[20]. Second, a few interviewees were to come back to Korea to carry out their military duties. All Korean male adults must serve in the military unless they have physical defects. Typically, in order to fulfill this, a Korean man would enter the military as a private and serve for 21 months. However, the people who pursue graduate degrees in science and engineering are given an alternative to complete this duty through working as a "Professional Researcher Staff". This option exempts them from all military obligations if he works in one of the pre-assigned companies for a minimum of 36 months upon graduation. For the foreign-educated elite engineers, this means that they are forced to return to Korea to work in industry[21].

Members of this group who had to return to Korea and chose Company A typically became increasingly frustrated at the company and began to seek alternative careers. If their return to Korea was imposed by a military obligation, they were not required to work for the company more than three years. This temporary obligation initially made it more palatable to work for Company A. But once they had embarked on careers in Korea, their chances of returning to the United States were substantially lowered except under very special circumstances.[22] As a job destination, Company A is viewed as not yet on a par with U.S. companies in terms of prestige and research quality. Meanwhile these elite engineers are aware that moving to other Korean electronics companies is not a solution either. Thus they are left with only two options: going into academia or switching to a different industry.

Moving to academia after working at Company A is not an option for many people. Quite a few interviewees said that they would rather work in industry than academia, either because industry jobs are

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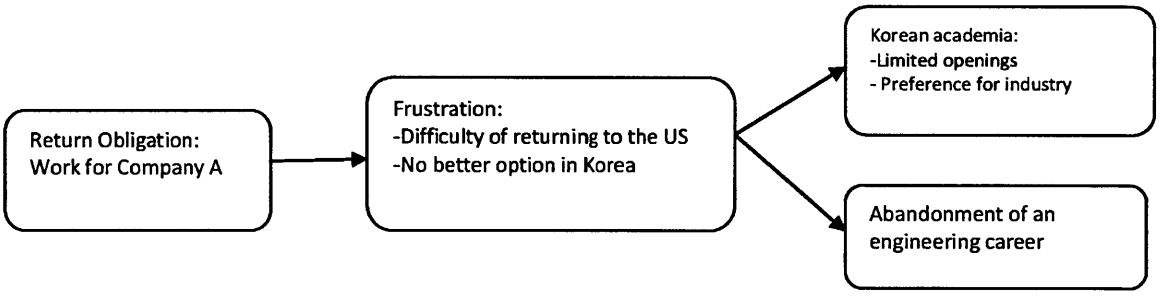
[20] Among the interviewees, there was one interesting case where a company-sponsored PhD chose to repay the company the tuition he received, because he wanted to work in the United States.
[21] All the information comes from Military Manpower Administration website (Source: http://www.mma.go.kr).
[22] In one case an interviewee's former professor in the United States founded a venture firm; he was recruited back to the States to work for that company.

more exciting or because the pay is better. The academic path is also constrained in that faculty job openings are few and far between, especially at the schools that this group would be willing to work for. A few interviewees speculated that there Company A attempts to discourage individual knowledge-creation activities that would enhance their chances of academic employment, so as not to acquire a reputation as a mere stepping-stone to academia. Consequently, elite engineers who were not bound for academia tended to end up in non-engineering jobs very remote from their advanced training and their initial passion. Among the alternative careers they chose or are currently considering are finance, consulting, and even medicine and law.

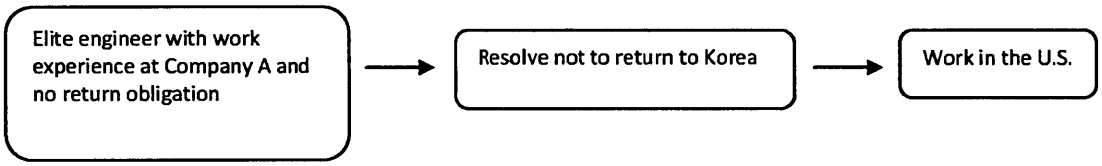
Path 1. Elite Engineer with a Return Obligation



The second path is the career pattern of those who were determined to remain in the United States, influenced by their own or friends' experiences at Korean companies. These people did not have a return obligation, and understood more clearly than most what it would be like to work in Korea. Their own experience and/or that of others had convinced them never to work for Company A. Many of the interviewees had had first-hand experience there before receiving their PhDs via summer internships, short-term employment or fulfillment of their military obligations. These people typically expressed the strongest preference for working at U.S. companies or research labs over returning to Korea. Even those

who ultimately aimed at a faculty position in Korea said that in the interim they would prefer working for a U.S. company over Company A because doing so contributes more to a successful résumé. From Company A's perspective, this is a serious loss. In fact, elite engineers' previous working experience would be very advantageous to both the company and the engineers. The company would have benefited from their expertise, and elite engineers could have enjoyed low information cost when they seek career options as they are familiar with the company. But exposure to the company is decidedly working against the company's interests by actively pushing away smart people.

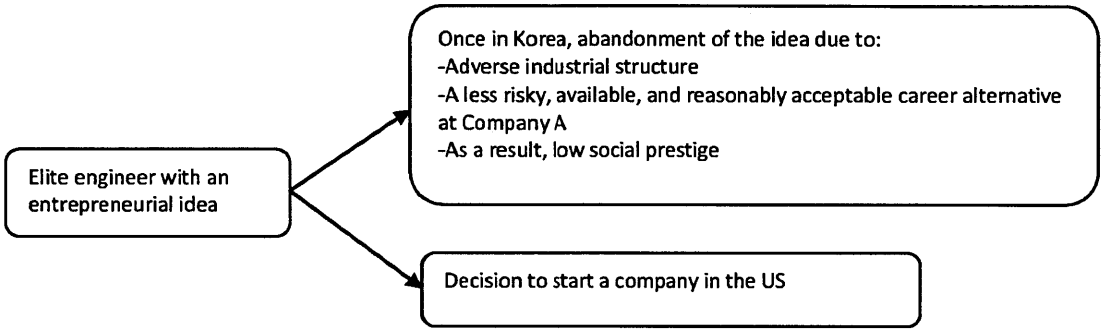
Path 2. Negative Past Experience



Third, Company A and the large-firm-oriented industrial structure of Korea that it embodies curb the entrepreneurial potential of elite engineers both directly and indirectly. The direct suppression takes place—or so the interviewees claim—when chaebols stifle small companies and water down radical ideas. Indirectly, chaebols discourage talented engineers from taking on the risk of starting a new company by providing them an alternative—but far from satisfying—career option. Korean elite engineers are different from their counterparts from other developing countries in this regard, as they have no fall-back career options comparable what Company A provides. This pattern results in a lack of role models for those with entrepreneurial ambitions, which in turn results in entrepreneurship's low social prestige. The outcome is a vicious cycle, one factor reinforcing the others to drive out those who are serious about starting a company within Korea's borders. After considering all the insurmountable drawbacks in Korea,

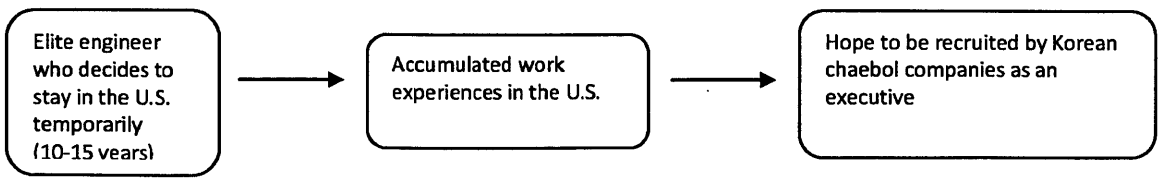
these people would rather remain in the United States despite the cultural and language barriers they encounter.

Path 3. Frustrated Entrepreneurship



Finally, a handful of interviewees intended to return, to become executives at Korean companies. But even they thought that building prior career history in the United States would be far more beneficial than returning to Korea promptly upon graduation. This significant point means that at least some elite engineers feel compelled to spend what are apt to be their most professionally fruitful years outside of their home nation *even when they have a strong intention to return.* This career track is the most passive in nature; it essentially involves waiting for a Korean company to make an overture rather than actively pursuing this goal. But it seems to remain a real possibility in the minds of elite engineers working in the United States—nearly one-quarter of the interviewees among those working in the US alluded to this path—and it is likely that many of the most talented and well-connected engineers will opt for it.

Path 4. Non-Returnees Opting for Executive Positions at Chaebol Firms



All things considered, it is surprising that the presence of large and successful home-country companies does not have a positive effect on that country's elite engineers, but in most cases quite the opposite. Paths 1 and 3 are especially useful for understanding this phenomenon. In both scenarios, the elite engineers could have better utilized their hard-earned knowledge were it not for Company A's dominance and its success both at the individual level and for the home country's development.[23] People who are on the Path 1 waste their potential to create meaningful knowledge as professional engineers. Path 3 results in the loss of the most transformative type of knowledge and job creation. In this regard, the achievements of Korea's highly successful companies still fall short. Is there a way for them to improve their strategy vis-à-vis the country's most talented and best-educated engineers?

7. Lessons: An Outlier Case

One couple's experience may illustrate how Company A could attract and retain elite engineers given the right conditions and incentives. Thus this outlier case offers some significant insights on how the company might arrive at a mutually beneficial equilibrium with elite PhDs. The two engineers, both of whom had earned PhDs in electrical engineering and computer science at MIT, both joined Company A as non-executives, though neither had a return obligation, and were satisfied with their careers. The couple attributed their contentment primarily to their sense of doing meaningful work at the company. In both cases their starting points at the company differed somewhat from those of the disgruntled majority. The wife chose to work for Company A-1, a much smaller affiliate of the business group that Company A belongs to. The husband was recruited by Company A, because of his research topic at MIT.

Company A-1 specializes in producing optical instruments like cameras, semiconductor parts and defense technology. It pales in comparison to Company A in terms of size, influence and prestige. It

[23] In terms of knowledge utilization from the home-country perspective, Path 2 is superior to Path 1. If one sticks with engineering, the possibility remains to contribute to home-country industry, if only by joining a scientific diaspora that can indirectly support the home-country economy (Meyer & Brown, 1999).

employed fewer than five thousand people in 2010, and its profits are much lower than those of Company A. The wife nevertheless chose to work there because she suspected she would fit in better:

> *I really didn't want to go to Company A . I didn't like the competitive atmosphere there. And Company A-1, they were really persistent about having an interview with me. . . . Although I went there [for an interview] with an unwilling heart, I ended up really liking them; the atmosphere there was so human. I still have this scene in my mind even to this day. The team leader [of A-1] who walked over to do an interview with me asked, "Were you interested in robots from young age?" That was actually the first time I looked at my résumé, and realized that there were so many times the word 'robot' written on it. I liked robots from my elementary-school days, but forgot about it as I started to be buried in so many different research areas. . . . Somehow that scene remained in my mind; I thought about it on my way back home from the interview. Can this company be the place for me? I was so thankful that the team leader could give such a personal comment. He pointed out something about myself that I was not aware of. If I ever go to industry, I will pick this company, I thought.*

This initial encounter suggested that she would be given opportunities for personal growth and development at Company A-1 that would be impossible at Company A. And she was right. The flexibility of a smaller organization, the greater visibility of individual contributions, a more laid-back culture, and the smaller likelihood of a job-skills mismatch all contributed to her high job satisfaction.

> *I am treated so well in A-1. It is a small company compared to A. One hundred thousand versus four thousand employees—so different. A-1 really makes efforts to accommodate me. They think I am a big deal. . . . Company A is different. There are a lot of PhDs there, and many are from prestigious schools. . . . They do not lack anything. But as for A-1, I feel there's a meaningful job that I can do, that I can make a difference. I feel that the company should make more money and I want to help. Among the 4000 employees, only 1400 are in R&D. And the core R&D people who have PhDs are still a fragment of those.*

Meanwhile at Company A, her husband is regarded as special in that he was recruited for his specific knowledge and training. The timing could not have been better. As he neared graduation and began searching for a job, Company A happened to expand into an area that precisely overlapped with his research topic at MIT. Thus he avoided the problem of job-skill mismatch. Instead, he feels that his work is valued by the company and that he can make unique contributions doing research that interests him. In the words of his wife:

> *As his graduation approached, it became clear there was no position that fit his specific research, even if he went to Intel. . . . And at the same time Company A happened to start investing in his research area. Before that, they said they would not do it because it was a technology that's too forward-looking. But they overturned the decision and started to pursue it. So he had interview with them. And after receiving the offer and working there, he really liked it.*

8. Conclusion

The Korean electronics industry boasts stellar growth, but its future success in the competitive global market is by no means guaranteed. China is in hot pursuit, fueled by massive financial resources from global investors. And China is gaining competence in knowledge production as well. According to a recent report from the Samsung Economic Research Institute, China has 1.6 times as many R&D personnel in IT as does Korea, and their publications are 2.5 times as numerous as those authored by Koreans. China also ranks second to the U.S. in the accumulated number of papers in the top 10 IT academic journals, while Korea is in tenth place (Ryu, 2011). At this point, the decline of Japanese electronics companies in the 2000s after Korean companies caught up with Japan in the marketplace should serve as a serious warning.[24]

[24] Japanese companies enjoyed 80 percent of the DRAM market at one point, but by 2009, the total joint operating profit of Japan's nine largest semiconductor companies was only half that of Samsung Electronics.

In particular, the suboptimal management of engineering talent is an issue that must be tackled immediately. The ex-chairman of Samsung, Lee, Kun Hee famously proclaimed in 1993 that "One genius can earn the living for one hundred thousand people." A 2003 newspaper article reported that Lee had instructed Samsung's presidents "If you cannot get geniuses, then at least sweep in all the quasi-geniuses you see." This directive stimulated competition to recruit top U.S. graduates (Choi, 2005). But if Samsung and other Korean chaebols cannot offer career opportunities that are meaningful and exciting to such talented prospects, all such efforts will be in vain. This is a suboptimal outcome for all parties: the elite engineers whose talents go to waste, the company that fails to utilize them, and the national economy that loses out on possible job creation and wealth creation.

References

Amsden, Alice. 1997. South Korea: Enterprising Groups and Entrepreneurial Government. In *Big Business and the Wealth of Nations,* edited by Alfred D. Chandler, Jr., Franco Amatori & Takashi Hikino. Cambridge University Press.

Amsden, Alice. 2010. Say's Law, Poverty Persistence and Employment Neglect. *Journal of Human Development and Capabilities,* 11(1).

Amsden, Alice H., and Takashi Hikino. 1994. Project Execution Capability, Organizational Know-how, and Conglomerate Corporate Growth in Late Industrialization. *Industrial and Corporate Change* 3 (1): 111-147.

Bhagwati, J., & Dellalfar, W. 1973. The Brain Drain and Income Taxation. *World Development, 1,* 94-101.

Choi, H. "Lee Kun Hee's Talent Management: If Not Genius, Get Quasi-Geniuses." Chosun Daily. Web. 26 Jun. 2003. In Korean. http://www.chosun.com/economy/news/200306/200306260325.html

Chun, H., Lim, S., & Cho, H. (2005). *Digital Conqueror, Samsung Electronics.* Maeil Economics Newspaper Publishers, Seoul, Korea. In Korean.

Forbes Korea (Editorial Staff). "100 Richest Venture Executives in Korea." Forbes Korea. Web. 19 Jul. 2005. In Korean. http://magazine.joinsmsn.com/forbes/

Greenwood, R., C. Oliver, K. Sahlin, & R. Suddaby. 2008. *Sage Handbook of Organizational Institutionalism.* Sage Publications.

Jeong, H. "Why There Are No Korean Star CEOs in Silicon Valley?" DongA News. Web. 13 Sept. 2008. In Korean. http://www.donga.com/fbin/output?n=200809130207

Khanna, Tarun. 2000. Business Groups and Social Welfare in Emerging Markets: Existing Evidence and Unanswered Questions. *European Economic Review* 44(4-6), 748-761.

KBS World Radio. "Semiconductors Led Exports in 2010." KBS Radio News Text. Web. 3 Feb. 2011. In Korean. http://world.kbs.co.kr/english/news/news_Ec_detail.htm?No=79187&font_size=14&id=Ec

Kevles, Daniel. 1993. "R & D Powerhouses." Science. American Association for the Advancement of Science. 260 (5111). 1161-1163.

Kim, K. 2006. "R&D Personnel in Samsung Electronics Surpasses 30,000." Chosun News. 26 Dec. 2006. In Korean. http://news.chosun.com/site/data/html_dir/2006/12/26/2006122601315.html

Lee, H. 2004. "The Human Network and the Power of Electrical Engineering Majors from Seoul National University, Now in Its Glory Days" *Shindonga Magazine,* 534, 254-267. In Korean.

Lee, J., & Saxenian, A. 2009. Do We Need a Double-edged Sword? Triggering Networking of Silicon Valley Korean Diaspora and Their Contribution to Home Country Institution Transformation. *Presented at International Conference on Diaspora for Development, World Bank.* Washington, DC.

Lee, S., & Brinton, M. 1996. Elite Education and Social Capital: The Case of South Korea. *Sociology of Education,* 69(3), 177-192.

Lee, S. "1 Out of 10 KOSDAQ CEOs Are From Samsung." Asia Economy News. Web. 2 Nov. 2009. In Korean. http://cn.moneta.co.kr/Service/stock/ShellView.asp?ArticleID=2009110210362401656&LinkID=263

Lim, S. and Kwak, S. "KOSDAQ CEO, 1 Out of 10 Are From Top 10 Companies." Yonhap News. Web. 6 Aug. 2007. In Korean. http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=102&oid=001&aid=0001718099

March, James P. & Johan P. Olson. 2006. Elaborating the "New Institutionalism". In *The Oxford*

Handbook of Political Institutions, edited by R.A.W. Rhodes, Sarah A. Binder & Bert A. Rockman. Oxford University Press.
Matthews, John A., & Dong-Sung Cho. 2000. *Tiger Technology: The Creation of a Semiconductor Industry in East Asia.* Cambridge University Press.
Meyer, Jean-Baptiste & Mercy Brown. 1999. Scientific Diasporas: A New Approach to the Brain Drain. *UNESCO ICSU Conference Paper.* Budapest, Hungary.
MIT News Office, 2010. Engineering, Science and Management Graduate Programs Continue to Excel. http://web.mit.edu/newsoffice/2010/usnews-rankings-0415.html
North, Douglass. 1991. *Institutions, Institutional Change and Economic Performance.* Cambridge University Press.
Obukhova, E. 2009. Does Brain Circulation Promote International Development? High-Skilled Migration and Organizational Performance. *Paper presented for GEM Seminar, MIT Sloan School of Management.*
Patton, M. Q. 1990. *Qualitative Evaluation and Research Methods* (2nd ed.). Newbury Park, CA: Sage Publications.
Piracha, M., & Vadean, F. 2010. Return Migration and Occupational Choice: Evidence from Albania. *World Development,* 30(8), 1141-1155.
Polanyi, M. 1962. *Personal Knowledge: Towards a Post-critical Philosophy.* University of Chicago Press, Chicago.
Powell, Walter W., & Paul J. DiMaggio. 1991. *The New Institutionalism in Organizational Analysis*. The University of Chicago Press.
Pyun, Lynn. 2012. Do Institutions Matter in Knowledge Creation? Quantifying the Impact of Institutional Affiliation on R&D Professionals. *MIT PhD Dissertation.*
Ramana, N., & Khanna, T. 2010. Diasporas and Domestic Entrepreneurs: Evidence from the Indian Software Industry. *Journal of Economics and Management Strategy*, 19(4), 991-1012.
Rosenzweig, M. 2010. Global Wage Inequality and the International Flow of Migrants. *Working Papers 983. Economic Growth Center.* Yale University.
Ryu, J., Eom, D., & Kwon, H. 2011. Brain Factory China – It Already Surpassed Korea. *CEO Information, Samsung Economic Research Institute Report*, 810, 1-21. In Korean.
Saxenian, A. 2006. International Mobility of Engineers and the Rise of Entrepreneurship in the Periphery. *UNU-WIDER Research Paper,* No.2006/142.
Saxenian, A. 2006. *The New Argonauts*. Harvard University Press.
Saxenian, A., & Hsu, J-Y. 2001. The Silicon Valley-Hsinchu Connection: Technical Communities and Industrial Upgrading. *Industrial and Corporate Change,* 10, 893-920.
Schumpeter, J. 1942. *Capitalism, Socialism and Democracy.* Harper Perennial.
Scott, Richard. 1995. *Institutions and Organizations.* Sage Publications
Siegel, Jordan I., & James Jinho Chang. 2006. Samsung Electronics. *Harvard Business School Case*, 705-508.
SKKU Business Research Center. 2010. *Successful Cases in Crisis Management in Major Companies.* FKI Media. In Korean.
Song, H-J. 1991. Who Stays? Who Returns? The Choices of Korean Scientists and Engineers. *PhD Thesis, Harvard University, Cambridge, MA.*
Song, J., Almeida, P., & Wu, G. 2003. Learning-by-Hiring: When Is Mobility More Likely to Facilitate Interfirm Knowledge Transfer? *Management Science,* 49(4), 351-365.
Sorensen, C. 1994. Education and Success in Contemporary South Korea. *Comparative Education Review*, 38(1). 10-35.
Ungson, Gerardo R., Richard M. Steers & Seung-Ho Park. 1997. *Korean Enterprise: The Quest for Globalization.* Harvard Business School Press.
Wadhwa, V., Saxenian, A., Rissing, B., & Gereffi, G. 2007. America's New Immigrant Entrepreneurs. *Report funded by the Ewing Marion Kauffman Foundation.* 1-41.
Webster, D. and T. Skinner. 1996. "Rating PhD Programs: What the NRC Report Says...and Doesn't

Say." Change. 28(3) 22-44.
Yoo, H-J. "Korean IT Companies Had a Victorious Year in 2010." Money Today News. Web. 28 Jan. 2011. In Korean. http://www.mt.co.kr/view/mtview.php?type=1&no=2011012816170604195&outlink=1

Tables and Figures

Table 1-1. Number of U.S. Patents, by Nation (excluding United States)

Rank	Country	Number of Patents
1	Japan	35501
2	Germany	9000
3	South Korean	8762
4	Taiwan	6642
5	Canada	3655
6	United Kingdom	3175
7	France	3140
8	China	1655
9	Israel	1404
10	Italy	1346

(Source: USPTO website)

Table 1-2. Number of Patents Held by Top 10 Korean Holders of U.S. Patents, by First-Named Assignee, 2005–2010

First-Named Assignee	2005	2006	2007	2008	2009	Total
Samsung Electronics Co. Ltd.	1569	2306	2583	3325	3394	13177
LG Electronics Inc.	461	683	665	774	1044	3627
Hynix Semicondutor Inc.	353	438	400	435	584	2210
Samsung SDI Co., Ltd.	109	150	301	415	411	1386
LG. Philips LCD Co., Ltd.	314	379	411	246	1	1351
(Individually Owned Patent)	215	257	189	195	217	1073
Electronics and Telecommunications Research Institute (ETRI)	112	171	205	254	304	1046
LG Display Co., Ltd.	0	0	0	268	590	858
Samsung Electro-Mechanics Co. Ltd.	81	126	148	170	215	740
Dongbu Electronics Co. Ltd.	21	70	188	194	187	660

(Source: USPTO website)

Table 1-3. Korean and Taiwanese Immigrant Entrepreneurs in the United States, by Industry, 1995–2005

	Innovation/Manufacturing-Related Services	Bioscience	Computers/ Communications	Software	Semiconductors
Korea	0.02	0.1	0.06	0.02	0
Taiwan	0.06	0.03	0.17	0.03	0.1
Ratio of Koreans to Taiwanese	0.33	3.33	0.35	0.67	0

(Source: Modified from Wadhwa et al., 2007, pp. 22–24)

Figure 1-1. Conventional Wisdom: Virtuous Cycle

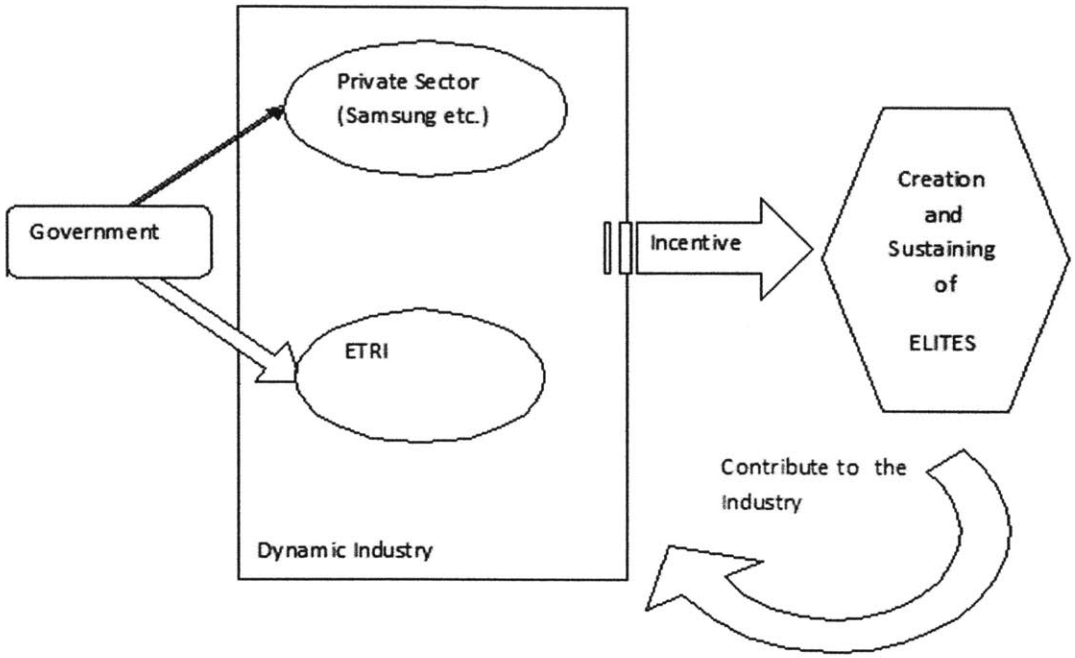
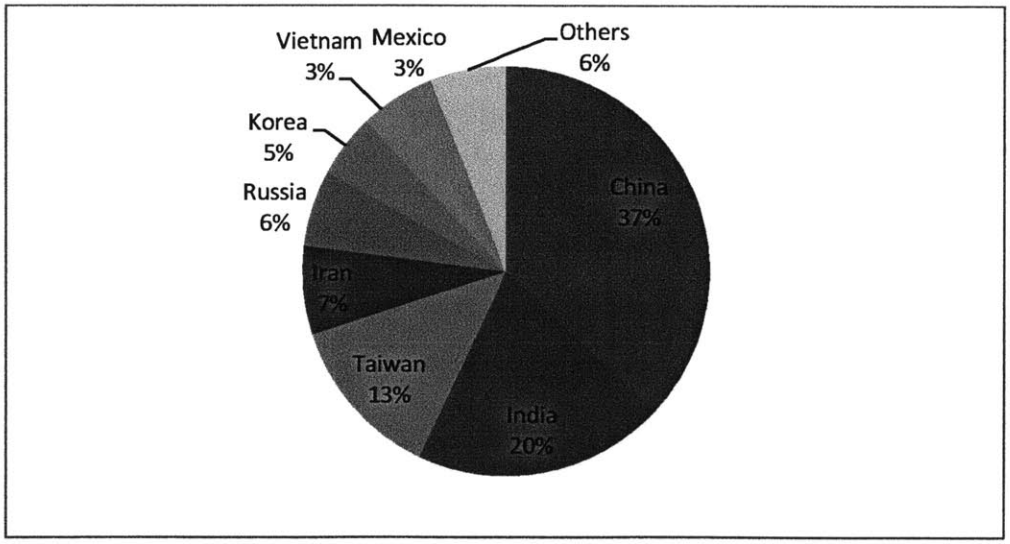
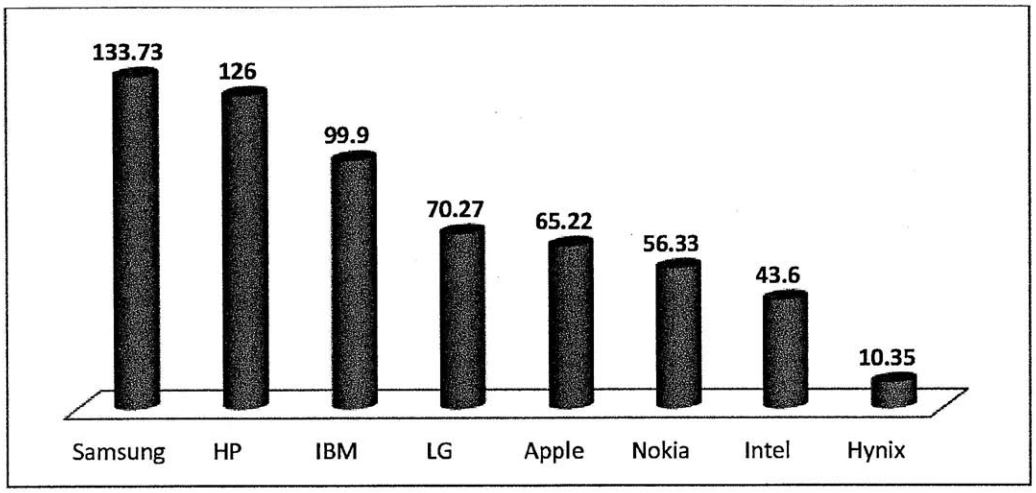


Figure 1-2. Professional Foreign R&D Professionals in the Silicon Valley Area, 1985-2000



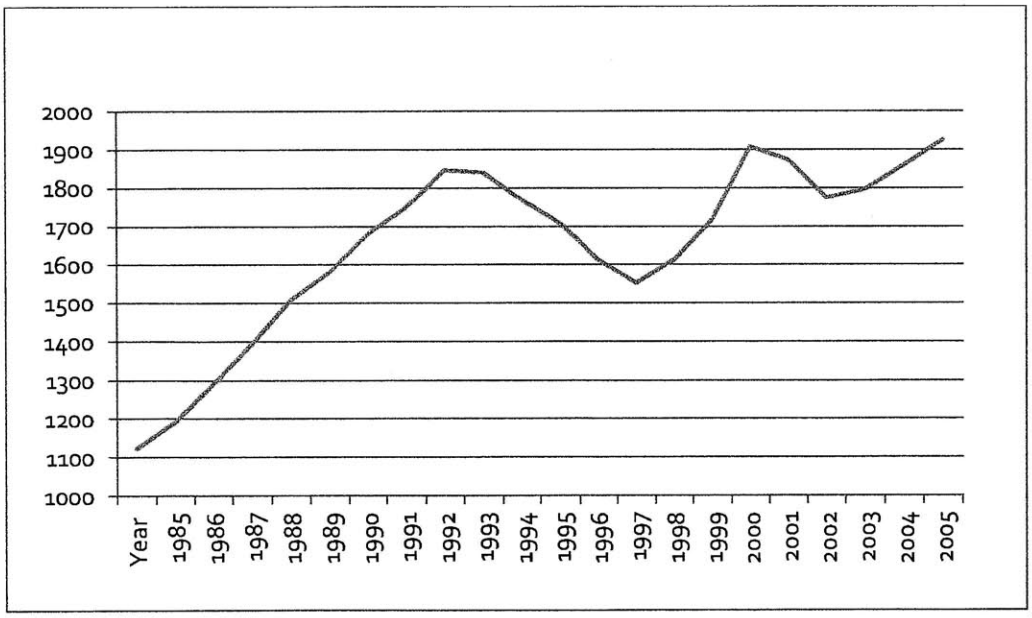
(Source: Saxenian, 2006: The New Argonauts)

Figure 1-3. Gross Sales, Top Global IT Companies, 2010 (in $ billions)



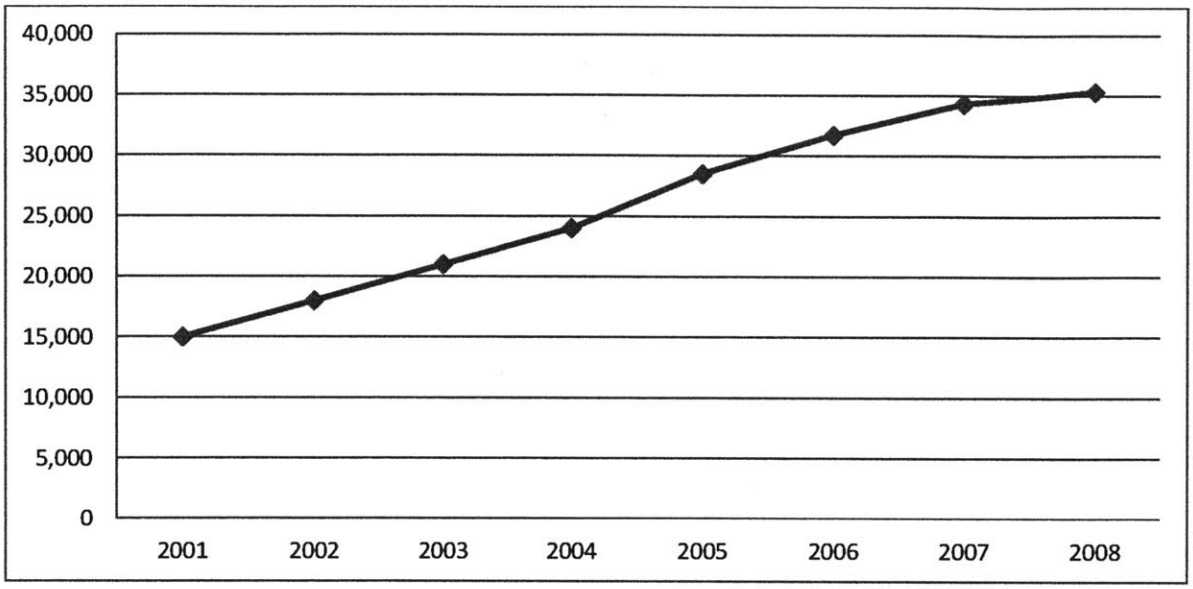
(Source: Money Today News, retrievable from http://www.mt.co.kr/view/mtview.php?type=1&no=2011012816170604195&outlink=1)

Figure 1-4. Number of Jobs at Korea's Electronics and Telecommunication Research Institute (ETRI), by Year



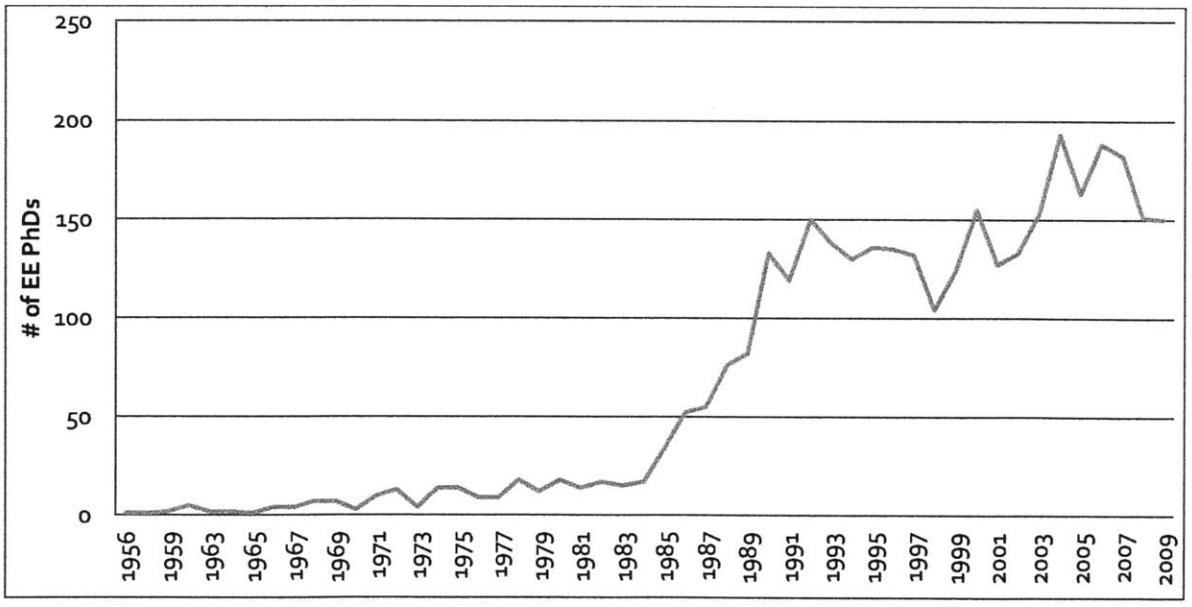
(Source: "The 30-Year History of ETRI", retrievable from http://www.etri.re.kr).

Figure 1-5. Number of Employees in R&D Positions at Samsung Electronics, by Year



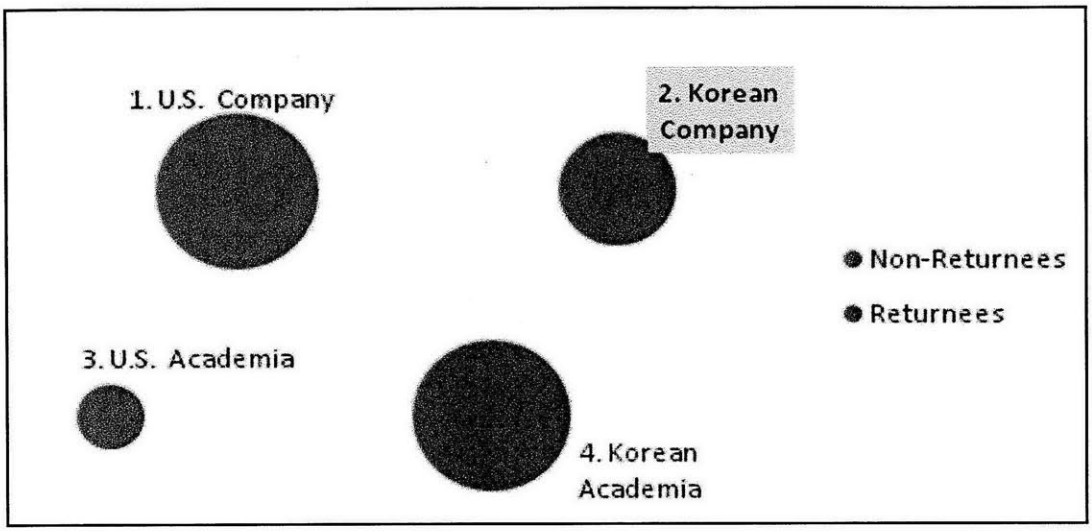
(Source: Chosun Daily News, retrievable from
http://news.naver.com/main/read.nhn?mode=LSD&mid=sec&sid1=101&oid=011&aid=0000163493)

Figure 1-6. Number of Koreans with PhDs in Electrical Engineering from U.S. Universities, by Year



(Source: Author's search on ProQuest Database, methodology specified in the main text)

Figure 1-7. A Visual Representation of the Relative Size of the Career Destinations of Returnees and Non-Returnees



Chapter II.

Multinational Firms, Labor Market Discrimination, and the Capture of Competitive Advantage by Exploiting the Social Divide[25]

1. Introduction

Women and ethnic minorities are frequently discriminated against in the labor markets of both developed and emerging economies, particularly when it comes to management positions (Brinton, 1989, 1993, 2001, 2007; Eagly and Carli, 2007; Estévez-Abe, 2007; Shirahase, 2007; Hewlett and Rashid, 2010; Mun, 2010). Such discrimination often takes the form of policies that have the real effect of perpetuating discrimination (Rosenbluth, 2007); it is also embodied in the actions of male purchasers and supply agents who prefer to deal with other men, and those of senior male executives who impose a glass ceiling on women's advancement to senior management (Brinton, 1993; see edited collection by Rosenbluth, 2007). Multinationals entering such markets must decide whether to aggressively hire and promote the excluded group, thus reaping the benefits of their underutilized talent, or to conform to local practice and avoid provoking bigoted policy makers, executives, purchasers, and/or supply agents (Hewlett and Rashid, 2010).

Prior organizational theory on multinational enterprises asserts that multinationals' foreignness is a clear liability, a key component of which is non-inclusion in and often ignorance of local networks in the markets in which they operate (Hymer, 1960/1976; Zaheer, 1995). In order to counteract the liability of foreignness, multinationals have been predicted to err on the side of local isomorphism in terms of

[25] This is a co-authored paper with Professors Jordan I. Siegel (Harvard Business School) and B-Y Cheon (Hanshin University).

social practices (Zaheer, 1995: 342), including most human resource management practices because they are typically the subject of strong local conventions and norms (Rosenzweig and Nohria, 1994: 231, 233). But a separate literature on the economic theory of labor market discrimination, starting with Becker (1957/1971) and using formal modeling and the U.S. example of the pre-civil-rights-movement era, suggests that firms might be able to enjoy a profit advantage by exploiting the bigotry of their peers and hiring the excluded group. That literature, though lacking strong empirical evidence on its profitability prediction, tends to predict opportunities engendered by being an outsider and actively exploiting bigotry embodied in certain networks' social consensus (Becker, 1957/1971). Our study challenges the organizational theory literature by building on theoretical insights drawn from the labor market literature.

We here have attempted one of the more rigorous tests ever conducted of the profitability prediction of the economic theory of labor market discrimination. Previous empirical work on this question has often lacked clear empirical results, and much of the empirical work has lacked panel data or the use of firm fixed effects to control for unobserved heterogeneity. Not only is dispositive evidence lacking on the general benefits of hiring excluded groups; there is also little or no evidence on the profit benefits or liabilities to multinational firms of actively hiring and promoting excluded groups in foreign labor markets. Also, prior studies of discrimination and profit effects have often focused on factory workers; we believe, however, that the effect of gender discrimination on firm performance may be more overt in the ranks of management, where hiring an excluded group like female middle and senior managers can have a direct impact on overall strategy and operational capabilities.

The ultimate goal of our study is to contribute to the organizational theory of the multinational enterprise by testing whether the significant competitive opportunities of the multinational include scanning the host-market social landscape, identifying social schisms in the labor market, and exploiting such schisms by actively hiring and promoting members of the excluded group to positions of management responsibility.

2. Literature Review

The principal contribution of neo-institutional theory has been to show that organizations, in order to survive and grow with the help of outside resources and certification, are often legitimacy-seeking and not solely efficiency-maximizing. In order to gain legitimacy, organizations find that they must conform to the social patterns and behaviors of dominant actors in their environment. The neo-institutional literature, with its focus on the multiple institutional pressures toward conformity with local norms that legitimacy-seeking firms face (Meyer and Rowan, 1977; Meyer and Scott, 1983), has elucidated the role of multinationals in forcing their own suppliers to adopt ISO quality certification (Guler, Guillén, and Macpherson, 2002) and the role of the state in mandating local practices in preference to global business practices (Guillén, 2000). Thus the neo-institutional literature has shown that the state and powerful actors can mandate certain local practices as a condition of doing business, support the dominance of locally divergent organizational forms (Orrú, Biggart, and Hamilton, 1996; Aguilera, 1998; Biggart and Guillén, 1999; Guillén, 1994, 2001), and even help prevent the pressures of globalization from changing locally dominant practices and organizational forms (Guillén, 2001).

There is a gap in the theory, however, when considering an important dilemma frequently faced by social outsiders in numerous institutional environments: a generic outsider must decide whether to conform to locally institutionalized norms that embody a social preference or social schism at the expense of a particular group, where the excluded group represents an underutilized talent source and thus a potential source of competitive differentiation. Jepperson and Meyer (1991) pointed to the role of the state in legitimizing certain norms and coercing firms under its jurisdiction to follow them. In the international context, the state's role has been confirmed by Hamilton and Biggart (1988). But what does the outsider do when a broad set of socially influential private actors acts through the state and the state's powers of policy enforcement to perpetuate a system in which women, or any other social group, are discriminated against in the local labor market? The specter of the state perpetuating a system of

discrimination is not far-fetched. In recent years, a multidisciplinary group of political scientists, political economists, and sociologists has argued that the state, via a system of policies and policy-enforcement actions, has acted to maintain the exclusion of women from the managerial labor market in a number of emerging economies and even in the advanced economy of Japan (see edited collection by Rosenbluth, 2007). The reason why socially powerful groups would use the state to perpetuate the exclusion of women is not esoteric. Doing so maintains privileged opportunities for males, or anyone in the dominant political coalition, to monopolize senior positions in management; it also maintains a system in which the excluded group is a potentially cheap source of lower-level production labor outside the sphere of privileged workers with legally mandated job protections.

A central insight of neo-institutional theory is that firms often need the legitimacy conferred by socially powerful actors in the economic environment just as much as they need efficiency. But what should outsiders do if the socially powerful actors exhibit a social bias that is clearly inefficient from the firm's perspective? The bigotry of the dominant group is reinforced by lax-to-nonexistent enforcement of discrimination laws, and by prevailing beliefs that males are better suited to leadership and that a homogeneous male leadership team is efficient because of the shared male drinking culture and/or shared experience of military forms of organization. Perhaps multinationals are potentially advantaged by the realization that, by virtue of being foreigners, they will never gain full legitimacy from the socially powerful actors. Perhaps, therefore, they should sometimes seek to exploit the biases of the socially powerful actors in order to gain competitive differentiation. The potential exists, too, for seeing a gradual progression toward a new meritocratic equilibrium, and for establishing oneself as an employer of choice for a new generation of socially powerful actors likely to assume political power, rewrite policies, and change enforcement norms a decade or more in the future.

Organizational theorists, particularly some neo-institutionalists, have emphasized the difficulty for multinational firms of navigating the often-conflicting institutional demands, norms, and pressures of multiple markets (Ghoshal and Westney, 1992; Morgan et al., 2001). We still know little about how

multinational firms can best deal with dissimilar labor-market institutions and norms, despite earlier calls for research on this question (Rosenzweig and Singh, 1991), though a recent natural experiment conducted by Siegel and Larson (2009) suggests that flexible intermediate adaptation can overcome most such institutional conflicts.

Within the international business literature, scholars of organizational theory have emphasized multinational firms' "liability of foreignness." Hymer (1960/1976), widely credited as the father of the global strategy/international business literature, noted the "difference in treatment because of nationality" (1960/1976: 29) that multinationals face when they venture abroad, due to "discrimination by government, by consumers, and by suppliers" (1960/1976: 34), and their unfamiliarity with how the country really works (1960/1976: 34). Zaheer (1995), expanding on what Hymer called the disadvantages of being foreign (1960/1976: 43), coined the term "liability of foreignness," subsequently used frequently in the literature. This alleged liability arises in part from being unembedded in local social networks, from lacking integration with the local information network (Mezias, 2002), and from what Zaheer (1995) called lacking roots, compounded by foreign firms' lack of overall legitimacy in the host environment. The principal theoretical lesson of this literature is that the multinational is an outsider without roots, and that being alien to the local social network is a performance liability (Zaheer, 1995).

It is worth at least briefly noting here that an altogether separate literature on status and conformity states that those with low status have the ability to act against norms without further hurting themselves (Phillips and Zuckerman, 2001). Edman (2009) has proposed that foreign companies are essentially outsiders without status and without expectations, and therefore they can afford to go against host-country business models. It is important to note just how much Edman's hypothesis goes against one of the core beliefs of the international business literature, namely that foreign firms are frequently the subjects of nationalism in a large number of countries and do in fact worry a great deal about not being seen to go against host-country expectations of how they conduct themselves in terms of core business practice such as who to hire in positions of leadership. That said, we find convincing the argument that

foreign companies have increased leeway in some areas, such as bringing in a new business model as Edman documents for multinational banks entering Japan. Yet we have seen through two years of fieldwork that multinationals likely do not have increased leeway to go against core principles of appropriateness when it comes to culture and gender. Such principles go to the very heart of the society's ideas of roles and responsibilities, and of the allocation of power. If multinationals are seen subverting the society's beliefs about the appropriate role of women, then those multinationals face a potential for a backlash from a variety of disparate but influential societal actors, including regulators, customers, business partners, and male employees.

Thus, while this study ends up concluding that multinationals have the ability to go against norms about female leadership, multinationals clearly do identify a serious backlash. Rather it is because the net benefits to these multinationals from employing female managers ends up outweighing the real backlash from male elite networks. Multinationals are not exactly low-status actors, as they have profitable business models that allow them to extend their business into South Korea, and they have much to lose or gain by the treatment from male elite actors in the host market.

That backlash, as we found out from fieldwork carried out when the first author visited Seoul repeatedly over the course of two years and as the second author resided in Seoul for a year, can come from male employees who refuse to be cooperative with a female boss, from male customers and male business partners who prefer male bonding rituals like drinking, and from male regulators who prefer to exchange favors with those they are most familiar with and can most easily trust. As examples of this, we were told in interviews of the male employees who refused to be cooperative with a female boss and even in some cases asked to be reassigned; of the female senior manager who was derided as a "lunch box" by male businessmen when going to a bar in which a great deal of business of conducted; and of conservative male regulators who preferred companies with male managers. Being conformist clearly buys labor peace and some reduced discrimination from many male regulators, business partners, and customers, and thus it is not the case that there are no payoffs to conformity (Phillips and Zuckerman,

2001) in the case of the multinational firm and core cultural practice. Indeed, worries of a "World War III" inside and outside of the organization were common. According to the senior manager of a European-owned executive-search firm that advised both Korean and multinational clients in Seoul, "There are clients who know there will be World War Three if they were to hire a woman above a certain level in the organization. Then you get gender-bias decisions being made" (interview by first and second authors, August 19, 2009). Even those who did much to employ female managers feared publicizing it. As one regional executive of a Western healthcare multinational put it, "We have a large number of female managers in our Korean organization, but we would not advertise it for fear of offending local men. It is not something that we publicize" (interview by first author, October 21, 2010). Thus, this is also not the type of situation in which the multinational faces no costs to being foreign (Nachum, 2003).

Therefore, it is an empirical question as to whether the net benefits to employing female managers outweigh the backlash from male elite actors. To preview our theoretical argument, multinationals are more aware of the opportunity than locals because they remain at least partially removed from network reciprocity obligations within Korean male elite networks and/or they are removed from the local belief system about the superior efficiency of homogeneous male leadership teams. This fact also serves to explain why the Japanese multinational may be seen to occupy an intermediate role between domestics and Western multinationals. They will be shown to employ significant more female managers than domestics, but less than Western multinationals. In interviews, we discovered that the major reason for this was that while they carried the belief system, they were distant from the local network obligations of reciprocity that enforce the belief system. This led them to begin to experiment in the 2000s with employing female managers.

Thus, in concluding this section, we reject the idea that foreign firms are low status and that therefore they can afford on that basis to be deviants. Instead, we will argue that foreign firms have to carefully outweigh the potential benefits of female managerial hiring against the expected and not infrequently encountered backlash from some economically important societal actors. It is the fact that

there is a tradeoff in which likely gains of underutilized talent are weighed against uncertain backlash makes this problem empirically interesting. It is interesting that while multinationals are more likely to hire female managers, a large percentage still do not hire any for fear of a local backlash. That was seen in an interview we had with the CEO of a European multinational. Even some multinationals eager to take advantage of the opportunity appeared to have been deterred from doing so by their local Korean managers. "Gender balance presents us with a nice large vein of talent that we can no longer ignore. Women have done unusual things that help them think differently about the same problems. They have had a career path and are a resource that has not been appreciated in Korea," the CEO of a European multinational told us. He then added, "I thought that I would hire a senior female manager in Korea, but my local management told me that women are not taken seriously by our customers" (interview by first author, October 14, 2009).

A separate body of literature examines the apparently remote question of why a competitive market would exhibit racial or gender discrimination. Becker's (1957/1971) economic theory of discrimination posited that discrimination is a consumption good of the firm's management, and that the firms that discriminate are those willing to pay more than the prevailing market wage (or to accept less than the market-available talent level) in order to employ only members of the favored demographic group. By this reasoning, firms that discriminate should experience lower profitability, and the firms that actively hire and promote the excluded group should enjoy higher profits. Over time, bigoted management should be selected out of the market as non-bigoted competitors either capture their market share directly or buy them out at a premium. Becker (1957/1971) pointed out that his predictions would not always hold, since firms that exercise market power, whether through government-endowed monopoly, government-enforced limits on foreign entry and competition, or firm-specific resources and capabilities, will fear rivals less and be more willing to pay the price of discriminating. Becker also predicted that unions would be more likely to push firms to discriminate against minority groups and women, an argument that may be an artifact of the 1950s–1970s era in which he was writing.

One of the more intellectually provocative predictions of this literature is that a profit opportunity may arise from hiring the excluded group, but the literature is so full of contingencies as to be unclear in its ultimate prediction. First of all, will discrimination even lead to lower pay for the excluded group? Becker originally predicted that it would, but later authors asserted that Becker's theory was really about segregation; in a competitive labor market, they argued, there might be firms populated by only one group or the other but their wages would be similar. But if there are differences in wages, or if discrimination primarily arises from senior employees with a personal incentive to preserve an economic boycott of the excluded group, or if the excluded group has a uniquely high level of productivity or a unique ability to identify market opportunities, there should be a profit difference. Over time, however, the profit difference should be competed away, unless one of the numerous contingencies proposed in the literature prevails: adjustment costs (Arrow, 1972, 1973), or the ability of monopolists to print money and avoid paying a penalty for discrimination (Becker, 1957/1971), or agency costs as senior employees perpetuate discrimination for selfish motives contrary to the interests of the firm's capital suppliers (Becker 1957/1971), or customer pressure on firms to discriminate (a point argued by Becker but later dismissed as unlikely to significantly affect an entire economy because a large proportion of jobs is hidden from the end customer).

One deficiency of the theory is that it is solely economic in its reasoning about *social* discrimination: it ignores the predeterminants of the preference for discrimination on the part of many capitalists in many countries. Why would the vast majority of Korean companies avoid hiring or promoting a single female manager? Becker (1957/1971) would credit a mere taste or dislike, but drawing on organization theory, economic sociology, anthropology, and history reveals a widespread popular belief in the efficiency of the homogeneous dominant group in the labor market.

South Korea is representative of a large set of countries where the dominant ideology states that men are better suited for corporate and political leadership (King and Mason, 2001), but also where women have in the past two decades already broken the barriers into just about all if not all management-

relevant educational fields (Hewlett and Rashid, 2010). What limits female access to leadership positions across numerous cultures in the developing world (plus Japan and at least some other advanced economies) are societal rules pushing many women to marry young and leave the professional workforce (Morrison and Jütting, 2004; Rosenbluth, 2007). Restrictive inheritance norms found across developing countries, along with the practice of dowry that is still found in some developing countries, also effectively impede women from more frequently assuming roles of economic significance (King and Mason, 2001; Morrison and Jütting, 2004). Other social norms that are discriminatory are only slightly more subtle. In Latin America, a social norm revolving around the aggressiveness of males—including using their economic power to hold women back from leadership aspiration—is glorified in many parts of society, including elite culture, through the so-called culture of *machismo* (Sara-Lafosse, 1998; King and Mason, 2001). Even in the U.S., Powell et al. (2002) show through survey evidence that gender stereotyping holding that women cannot be effective managers continues to be persistent. What is striking is that at the same time these cultural barriers persist to impede female managers' advancement, it is a striking phenomenon just how universal women's rise to educational attainment has been since 1990. As noted by Hewlett and Rashid (2010: 2) in a recent practitioner-oriented article on female talent, fully 65 percent of college graduates in the United Arab Emirates, 60 percent in Brazil, and 47 percent in China are women. In the Korean context, the educational glass wall started falling in 1990 as part of a global phenomenon in which democratization leads political actors to try and incorporate excluded groups by first extending educational access (Ramirez, 1987; Bradley and Ramirez, 1996; Meyer et al., 1997).

Thus, to take the example of South Korea, this is a country which is representative of a large number of countries in its traditional belief that men are better equipped for positions of leadership (Slote and De Vos, 1998; Li, 2000). South Korea belongs to the group of nations—along with China, Japan, Taiwan, Vietnam, and Singapore—known as the Confucian Core, where Confucian-inspired beliefs are still taught and practiced in everyday social life. As Tu (1998: 5) has observed, "East Asians may profess themselves to be Shintoists, Taoists, Buddhists, Muslims, or Christians, but rarely, if ever, do they cease

to be Confucians." Confucianism did not invent gender bias in East Asia (Li, 2000); some scholars have pointed out that Confucianism overlaid regard for integrity, education, caring, and good governance on pre-existing social biases (Chou, 1998). The fact remains that Confucianism is an ethical system through which restricted female roles have been reinforced by male elites (Hall and Ames, 2000). Confucius states in the *Analects* that King Wu of Zhou had nine male advisers and one female adviser, but remarks that fortunately there was plenty of male talent in the society and thus the single female should not really be counted among the king's advisers (Li, 2000: 3). Deuchler (1992) and Duncan (2000) discuss how, immediately prior to the widespread adoption of the conservative neo-Confucianism in South Korea, women enjoyed equal inheritance rights and equal roles in the all-important ceremonies of ancestral worship. Women were even occasionally societal leaders during the Shilla dynasty (Duncan, 1998: 86). During the Goryeo dynasty (918–1392), women not only continued to possess equal inheritance rights, but also could desert an incompatible husband, divorce, and remarry without any social stigma (Deuchler, 2003: 143). While Confucianism was not directly responsible for the extreme restriction of women's social and economic role that occurred after 1400, its gender-related precepts were used during the 1392–1910 Joseon dynasty by male elites to gradually restrict women's role in the public sphere (Deuchler, 2003).[26]

Paradoxically and perhaps inadvertently, Confucianism also helped plant the seeds of women's recent re-emergence in public life and questioning of traditional ideas about women. While Korean democratization was instrumental in encouraging expanded access to education, the seed of women's re-emergence in public life was likely aided by the traditional encouragement of female access to books and study. Both Confucius and Mencius were home-schooled in ethics and historical writings by their mothers, and their writings explicitly assert that women should be allowed to study and to attain self-

[26] We adopt the contemporary method of Romanization of Korean words in this paper (with this method formally called "Revised Romanization" and put into practice during the administration of President Kim Dae Jung in July 2000). When referring to the Joseon dynasty, Joseon is alternatively spelled Chosŏn in the McCune-Reischauer transliteration method. Also, in the Korean language, the managerial titles chajang and bujang stay the same when going from singular to plural (except that a Korean suffix may be attached at the end). To make ourselves more readily understood to an international set of readers, when referring to the plural form of chajang and bujang, we use "chajangs" and "bujangs" in English writing.

awareness through access to books (Li, 2000). Confucianism also assigned certain specific powers to women: financial management of the home, home management, and deciding the future of the children (Cho, 1998). Already as of the early to mid-1990s, South Korea did not lack eligible female graduates of business schools, engineering schools, economics departments, and foreign-language departments. Numerous female managers whom we interviewed spoke proudly of the fact that Korean women had significantly increased their advancement through meritocratic competition as judges, prosecutors, civil service officials, and even military officers during the succeeding decade. Female advancement in these aforementioned and formerly almost male-only professions was occurring on a vast scale. Fully a quarter of all active Korean judges were women by the end of the succeeding decade (Lee, 2010).

To return to empirical explanations for the norm of homogeneous male leadership groups, the second justification offered by Korean executives we interviewed—also articulated in historical Korean writings—is that male life experience is unique and that homogeneous male groups are efficient at drawing on that experience when organizing economic life. From this perspective, shared understandings and beliefs arising from the male life experience, including compulsory military service, equip men to absorb a set of command-and-control practices and to understand tacitly how to act most efficiently as a group; when the leader makes a decision, for example, everyone needs to pitch in to achieve the objective (Janelli, 1993). Thus a homogeneous group of Korean men can draw on the organizing practices of the military to get things done without delay (Kearney, 1991), whereas women without military experience may suffer from a culture clash and may lack the requisite know-how. This belief calls to mind the findings of sociological studies on social homophily and its potential contribution to employee satisfaction (Blau, 1977; Nielsen, 1985; O'Reilly, Caldwell, and Barnett, 1989). Thus, though economic theory ignores mass ideology about the hypothetical efficiencies of male homogeneity in leadership groups, the fact that much of Korean society largely believes in the empirical truth of this ideology renders the debate about whether or not it benefits companies to hire women and minorities both intellectually interesting and potentially socially meaningful.

Perhaps unsurprisingly, there is no consistent and rigorous empirical evidence. Prior results testing the profitability prediction of the economic theory of discrimination have been mixed. Some executives we interviewed mentioned a short article in *McKinsey Quarterly* (Desvaux, Devillard-Hoellinger, and Meaney, 2008) reporting that among 101 U.S. (and possibly other western) companies, those with at least three female executives were likely to be better managed, a finding that in turn correlated with better financial performance and valuation. While suggestive, the sampling criteria are unclear and the pairwise correlations lack statistical rigor and do not control at all for unobserved firm heterogeneity.

In the academic literature, the evidence is also surprisingly inconclusive. One set of studies examines whether realized pay discrimination in the United States increases or decreases with monopoly power and trade competition. Ashenfelter and Hannan (1986) found that monopolistic U.S. markets exhibit more gender discrimination. Within those monopolistic markets, most firms (even those with relatively less market power) discriminated against women. Black and Brainerd (2004) used U.S. data to show that industries with growing exposure to global trade exhibited less gender discrimination over time.

Another set of studies examined whether the realized pay discrimination differential in labor markets is primarily due to productive differences among groups or to actual discrimination. Here the evidence has been especially mixed. Hellerstein and Neumark (1999), using data from Israel, attributed most of the pay differential to productivity differences, not discrimination. But the same year Hellerstein, Neumark, and Troske (1999) used the Worker Establishment Characteristics Database to find evidence of gender pay discrimination in the United States.

A third set of studies has examined whether any performance benefits result from hiring excluded groups across countries. Deszo and Ross (2009, 2012) reported that having a female CEO had a negative effect on corporate performance among U.S. companies, but that having a top-five female executive had a positive effect when U.S. companies that chose not to report R&D expenditures were excluded. Appold,

Siengthai, and Kasarda (1998) relied on self-reported financial data on a sample of 91 companies with data on demography for "supervisory" positions in Thailand in the mid-1990s and found that foreign firms had fewer women in supervisory positions than local Thai firms and that having more women in supervisory positions had no significant effect on return on assets. With publicly audited financials, more detailed demographic data on management levels, and a much larger and nationally representative sample of firms, one wonders what the demographic difference and performance implications might have been. Similarly, other authors such as Adler (1993) have predicted that foreign multinationals would benefit from hiring women but had to rely mostly on anecdotal performance evidence to frame their predictions. Szymanski (2000) in turn showed that English soccer-league clubs with a higher proportion of black players outperformed other clubs on the playing field, even after controlling for the wage bill. The latter finding is an encouraging result for our study, but the question remains whether sports-league owners are all profit maximizers or whether some view their clubs as a consumption good and are thus more willing to pay a profit penalty for discrimination than is typically the case in other parts of the global business world.

Most other studies have findings in the predicted direction but with less than dispositive results. Smith et al. (2005) find that, in the presence of fixed effects, there is no statistically significant effect of female senior management on firm performance among the 2,500 largest Danish firms during 1983–2001. It is unclear whether that non-result is due to the study taking place in Denmark, a country known for its nearly world-leading high level of egalitarianism (Siegel, Licht, and Schwartz, 2011). Hellerstein, Neumark, and Troske (2002) found cross-sectional evidence in the United States of a profit benefit from hiring women at firms in industries with product market power; they also found that firms that discriminated against women were punished over time with lower growth or buyouts by nondiscriminators. The remaining question here is whether the cross-sectional evidence would be robust to a panel analysis with firm-level fixed effects. Also, the result that the profit benefit was greatest in

industries with product market power actually contradicts one of the primary predictions of Becker's theory and of Ashenfelter and Hannan's (1986) prior empirical result.

From Japan, on the one hand, we do observe prior empirical evidence on demography that is relevant and encouraging for our study. Foreign-owned firms in Japan appear to have higher average percentages of female employees and lower average pay gaps between their overall male and female workforce. In the sociology literature on labor mobility, Ono (2007) presented evidence from a survey of 10,406 Japanese workers from larger cities indicating that Japanese women are more likely to work for foreign firms. A small sample of Japanese female MBAs reported in interviews given to Ono and Piper (2004) that they perceived fewer gender-based career obstacles in foreign firms. Ono (2010) found that among stock research analysts writing columns in the *Nikkei Financial Daily* between 2000 and 2007, the female stock research analysts were more likely to be working for foreign investment firms. Also, among 10,406 Japanese workers surveyed by Ono (2007), those women working for foreign-owned companies reported annual earnings that when tabulated were shown to be 28 percent lower than men working in foreign-owned companies, whereas the reported gender pay gap among those working for domestic Japanese firms was 43 percent. Ono and Odaki (2011) showed in a large-sample demographic analysis of one million Japanese workers using government data from the year 1998 that there was a lower average pay gap between women and men in foreign multinational subsidiaries in Japan compared to local Japanese firms.

Yet we, on the other hand, do not yet know if women working for foreign multinationals are more likely to break through the managerial glass ceiling in Japan and if promoting women to senior management has performance implications. No study in Japan to which we are aware has analyzed the effect of female management participation on corporate performance (with or without a useful control variable for overall female representation, since some bigoted male executives are known to block the hiring of female managers but still to prefer women in lower-level factory and administrative support jobs). The one known study from Japan analyzing the effect of female workers on corporate performance

in Japan had inconclusive results. Specifically, Kawaguchi (2007) found a profit benefit from having a higher proportion of female workers in Japan in the 1990s, but the firms that hired women did not grow faster over time and only 5 percent of the profit effect was due to gender discrimination. The remaining question about this study draws on Houseman and Abraham (2001), who showed that female workers in Japan were significantly more likely to be temporary workers. Thus it could be that the profit benefit attributed to the proportion of female labor in Kawaguchi's study was conflated with the effect of an increase in temporary workers as a percentage of all workers. This interpretation would be consistent with Kawaguchi's (2007) finding that most gender discrimination in Japan flows from productivity differences, not discrimination, although the effect of gender discrimination could increase once one controls for the effect of temporary workers. In summary, there is evidence suggesting a profitability effect, but prior studies have all had limitations and as a result there is no consensus about the size or importance of the profit effect in global business.

In any market with persistent discrimination, the actor most unfamiliar with prevailing societal ideology and unaffiliated with formative institutions like the military should be the most likely to recognize the profit potential of aggressively hiring and promoting talented members of the excluded group. Therefore we predict:

H1: Multinationals will be significantly more likely to hire and promote the excluded group.

H2: Multinationals will be significantly more likely to implement practices that support the hiring and promotion of the excluded group.

We know, however, from the economic theory of labor-market discrimination that multinationals are not unique in their ability to derive an advantage from hiring an excluded group. Therefore, to the extent that there is a profit opportunity in hiring an underutilized pool of talent, then all firms, foreign and domestic, that recognize the opportunity should be able to derive a performance benefit from doing so. Therefore we predict:

H3: Firms, both foreign and domestic, that do more to hire and promote women to positions of managerial responsibility will see higher levels of profitability.

3. The Korean Context

We conducted lengthy interviews with an extensive set of female managers, aspiring female managers, HR managers, CEOs, a former prime minister, and former President Kim Dae Jung, who agreed to an interview in what turned out to be the last month of his life. "I believe foreign-owned companies have less gender discrimination and put more focus on people's individual qualities regardless of gender. . . . Domestic companies have more of a male culture," former President Kim observed. He continued:

> To address that problem will take some time. . . . More and more women are successfully passing the high government official examinations, and females are very active and visible among government officials these days. In fact, a majority of those passing the high government exam and the bar exam are now women. There are now many women as prosecutors and judges. Also, even in the household economy, wives are the main players. Usually a man's salary is wire-transferred through Internet to the wife's account and so the man has to get an allowance from his wife" (interview by first author, July 4, 2009).

As the former president acknowledged, large numbers of women in the Korean labor market have demonstrated talent. Yet the vast majority of domestic companies do not have a single female manager. Multinationals are significantly more likely to have female managers; these individuals are almost always Korean women, not transferred non-Koreans. (Non-Korean female managers in South Korea are extraordinarily rare. We have compiled an exhaustive list of this small group and interviewed many of them via snowball sampling.)

Early on, we ruled out the possibility that enforcement of nondiscrimination laws was a significant factor in gender hiring. We found, in fact, that both lawsuits and prosecution involving gender discrimination were exceedingly rare—the list we compiled, which we believe to be complete, consists

of fewer than 15 cases since 1987—and that in some cases women suffered notable losses in court. The judge in the National Agricultural Coop case stated in his opinion that the company's dire need to reduce its workforce justified targeting women for layoffs. In an ongoing case involving a large Korean business group, Lee Sun Yi, the certified labor attorney representing the plaintiffs stated that, despite evidence suggesting that women earned only 65 percent as much as their male counterparts, the judge was likely to favor the employer because of its economic importance to the country: "As Hyosung is a large business group, the court is more sensitive towards the company than otherwise would have been the case. They believe they have to consider how their business interests may be affected—the company is too big and significant for them to ignore such concerns" (interview by second author, May 27, 2009). Some judges acknowledged that women had suffered discrimination but awarded them little or no compensation.

Another question was whether public image was forcing even otherwise bigoted employers to hire women. We found, first, that it was extremely rare for companies to publicize in any way that they had recently hired or promoted women; Samsung Electronics was one of the few exceptions. Further, we found male executives who were happy to explain why they did not have a single female manager. "I have no female managers. I tried having a female manager, and I would never do it again," said the CEO of a financial-sector firm. "I found that women are limited by emotional decision-making and that it causes problems. Maybe I might appear tomorrow in the newspaper as a chauvinist, but that is my real thinking" (interview by first author, October 14, 2009).

The female managers we interviewed told numerous stories of the adversity they had had to overcome. While some might expect female managers to be segregated in HR, we found female senior managers in every function, including operational heads overseeing large numbers of male blue-collar staff. One manager's story was typical: "One time the manager at the factory was at a dinner function and asked me if I would like to know what my name is at the factory. He said, 'Big Boobs.' There is a very high female turnover rate at that location. There was a female manager there who quit quickly because of sexual harassment" (interview by first and second authors, October 12, 2010). Numerous female

managers remarked on the high cost of child care in Korea, and said that they were able to progress in their careers only because they had remained childless or arranged for their mothers to raise their children.

The most senior multinational executives we interviewed were all aware that most local firms had no women in senior management. The head of HR for a foreign multinational reported: "When we do recruiting, typically female applicants have better qualifications in terms of standard measures. . . . So do females prefer us? Yes. Because males can target more broadly [to local companies] than women when looking for jobs" (interview by second author, January 6, 2010). And the head of HR management for Sony Korea observed: "Females understand Sony is a really good company for females. . . . I want to share my understanding for this issue as follows. At first I will say that female employees of Sony Korea, including managers, are relatively more competitive [higher-performing] than males. It is because of, one, local companies prefer males over females, and two, females have less opportunity in local companies" (interview by first author, January 10, 2010).

The same senior executives of multinational subsidiaries characterized local bigotry against women as universally apparent to multinationals. Furthermore, they acknowledged making a deliberate choice to try to exploit local bigotry. Of course, they were motivated in part by their awareness of the importance of attracting the best talent, but such decisions entailed weighing hiring choices against the impact of flouting the preferences of bigoted local customers, business partners, fellow executives, regulators, and policy makers. Consider the example of the previously quoted CEO of a European multinational. He delivered a speech extolling the opportunity to hire underutilized female talent, but then acknowledged in an interview that he had chosen not to hire a female executive at his Seoul office because local managers told him that customers were too bigoted to deal with a female. Even a progressive local firm with a female second-in-command experienced such pressure. "When we interview new job applicants, if we were to select only based on the score, we would have only women," this female leader told us. "We are up to 46 percent women. The problem is that the 40- and 50-year-old managers and customers on the outside are often men who are used to dealing only with men" (interview

by first author, October 13, 2009). In short, both interviewees knew that women are an underutilized source of talent, but both cited the difficulty of hiring and promoting women at senior levels given local prejudice and cultural norms.

The aggressive hiring and promotion of women to senior management by foreign multinationals is in part motivated by a calculation that the talent utilization outweighs the outsider liability of going against dominant local cultural norms. It is based on a relative prioritization of the competitive opportunity to exploit the bigotry of locals. The multinationals that make this calculation to aggressively hire and promote the excluded group often end up putting in place practices that go far beyond what is done in the home market. For example, the head of a major U.S. technology company's subsidiary in South Korea stated, "I just implemented a new plan. Let's say that we have 20 open managerial positions this year. When a male is hired over a female, [the hiring manager] has to send me an e-mail for clearance" (Interview with first author, January 19, 2010). And it is not the case that they are just a little more aggressive in South Korea than at home. Many of the Japanese multinationals had no or almost no female representation in management at home but yet had significant representation in South Korea, as will be discussed in detail in a later section of this paper. Even many of the heads of U.S. and European multinationals stated that the opportunity to exploit the bigotry of locals either caused them to make efforts they simply chose not to make at home, caused them to have women at senior levels they never or almost never had at home, or else caused them to be far more aggressive in Korea than they were at home. Thus, exploiting the bigotry of locals is often a part of the calculus, even if it is not always the sole reason for hiring women.

4. Data

We utilize two unique data sets from South Korea, a country that is representative of a wide set of emerging economies and some advanced economies for its level of gender discrimination. Across a

variety of related dimensions measuring the extent of gender-based disparity in the labor market, South Korea is actually disturbingly representative of a large number of peer countries, both most emerging economies and some advanced economies. To see that South Korea is not an outlier but rather a remarkably representative country case, one can focus on the available, comparable cross-country data about female participation in the overall workforce, female participation in professional positions, and the overall wage gap between women and men. For purposes of comparison, we focus in on the year 2005, given that it dovetails with the start of the sample time period for this study.

First, in terms of labor market participation, while South Korea's female labor participation rate was 50 percent in 2005 according to the World Bank's World Development Indicators (WDI) database, that ranks South Korea just below the median of 52 percent, above Japan (48.4 percent), above Spain (45.6 percent), Italy (37.7 percent), and Belgium (45.7 percent), above a wide cross-section of emerging and transition economies in Latin America, Africa, Asia, and Eastern Europe (including most prominently Mexico, Chile, South Africa, Nigeria, all of the Arab countries, India, and Poland), and just slightly below France (50.2 percent), Argentina (50.3 percent), Germany (51.4 percent), Hong Kong (51.8 percent), and Singapore (53.5 percent). Similarly, the female percentage share of all professional and technical workers in South Korea was rather low at 39 percent according to the United Nations Development Programme's (UNDP's) 2007/08 Human Development Report (which utilized data from Year 2005), and yet that 39 percent figure was comparable to the female shares in Hong Kong (40 percent), Malaysia (40 percent), Mexico (42 percent) and Singapore (44 percent), and only slightly below that of Japan and Italy (both 46 percent), and of Spain (48 percent) (Watkins, 2007).

When one turns one's attention to the gender wage gap, one sees that the ratio of estimated female to male earned income in South Korea according to the UNDP's Human Development Report is 0.40, which is lower than average but comparable to Japan (0.45) and Italy (0.47). It is also the same as the comparable value for Chile (0.40), slightly above Mexico (0.39) and Malaysia (0.36), and higher than Egypt (0.23). Data from the United Nations' Statistics Division encompassing the mid to late 2000s

shows that women's wages in manufacturing as a percentage of men's wages in South Korea is 57 percent, which is lower than the median of 72 percent, yet still is at a similar level with Colombia and Hong Kong (both 60 percent), Brazil and Japan (both 61 percent), and Austria (62 percent), along with being higher than a broad range of other emerging and transition economies. The above-referenced UNDP Human Development Report, again using data from 2005, presents an overall index of female activity that placed South Korea (with its score of 68 percent) slightly higher than advanced economies such as Japan (66 percent), Italy (62 percent), and Spain (66 percent) (Watkins, 2007). Among emerging economies, South Korea ranked on the UNDP's index slightly above Singapore (66 percent), and higher than Egypt (27 percent), Chile (52 percent), Mexico (50 percent), and Malaysia (57 percent) (Watkins, 2007). Overall, the picture we see is of a South Korea that appears quite representative in the extent of its labor-market gender disparities of a rather large set of peer countries around the globe.

We have looked the world over for a data set from an economy where labor market discrimination is known to be an issue and where we have detailed data on business-level policy decisions and hiring and promoting decisions in a nationally representative sample of firms, both foreign multinational affiliates and domestically owned firms, in a panel setting where firm fixed effects can be used, and where the dependent variable for profitability benefits from publicly audited financials. To our knowledge, South Korea is unique in having the data that meets all of these criteria.

The Korean context, as pointed out earlier, also has the virtue (not a social virtue, but a virtue for econometric identification purposes) of a high level of exogeneity in the choice to hire female managers. That is because the two main sources of endogeneity that have been proposed in past literature are that (a) companies might alternatively choose to employ female managers once they become profitable in order to avoid the increased scrutiny of law enforcement focused on equal employment compliance; and (b) companies might come more into the public eye through their increased profitability and then publicize their hiring of more female managers as a public relations move in order to avoid looking sexist. Not only is the law enforcement weak and highly deferential to company owners, but also, as pointed out

earlier, even those companies that employ a large number of female managers choose rarely to publicize that fact. As was delineated in a previous section, even multinationals that hire the most women are seen through our interviews to explicitly choose not to publicize it for fear of offending male elites. Also, there are also so few female managers among the domestics, and a check of possible causal determinants in the cross-sections indicates that only exogenous industry pockets of apparel and publishing were robustly more likely to have female managers. This is logical, given that for structural reasons in the labor market the overwhelming majority of the available talent in Korean apparel and publishing is female. Also, it is important to note that such industry influences are fully controlled for through our use of company fixed effects. Any time-invariant characteristic of the companies, including especially their industry affiliation, is absorbed as part of the fixed effects.

We believe that we further benefit from having an important source of distinction even across the two data sets. The first data set covers a nationally representative sample of firms, and thus it captures the overwhelming majority of firms with not a single female manager. The second data set has a significant screening criterion, where the survey collectors chose to focus on the firms with at least one female manager and thus see if female hiring continues to matter in a population of firms that are at least minimally diverse.

The first panel data set is the Workplace Panel Survey (WPS) from the Korea Labor Institute (KLI), a think tank headed by Ph.D.-level labor economists sponsored by the Korean government. The survey was conducted in Years 2006 and 2008, with the questions about companies' demography and human resource practices in the prior years 2005 and 2007. Because some companies are multi-establishment organizations, and the WPS surveyed them by going out to several of their establishments and asking them about their demography and hiring practices at each one, we have elected to aggregate those cases at the firm level. Our main dependent variable is ROA, defined as operating profit divided by total assets. The main variable of interest is the percentage of chajangs (deputy general managers), an upper-middle management position in South Korea in which women have recently begun to make

significant inroads. (Women are few and far between in more senior management positions, although in the other data set where companies are at least minimally diverse, the differentiation occurs on the more senior management position of bujang (general manager).) We have controlled for whether a firm has at least one female chajang, for the percentage of females who occupy the more mid-level management position of gwajang, for whether the firm has at least one gwajang, for the total female employee percentage in each firm. In addition for including firm fixed effects, we also include a year dummy for the observation taking place in year 2005 to control for all unobserved time-period effects.

In the WPS data set, we are able to utilize a broad set of control variables. Our financial control variables include the log of each firm's total assets, along with the firm's leverage, R&D intensity, and advertising intensity. The latter two variables on R&D intensity and advertising intensity are from data provided to the third author from the Korea Information Service, a leading credit-rating agency in South Korea. To account for the effect of unionization, we control for a dummy variable indicating whether a firm has an active union. To account for the firm's propensity and/or ability to hire younger workers, we control for the percentage of newly recruited workers among the firm's total employees. To account for the firm's dependence on non-permanent employees, we control for the percentage of fixed-term contract employees among the firm's total employees. Then, to control further for human resource policies that we find to have some pairwise correlation with ROA, we further control for whether a firm's support for healthcare expenses has been provided to go beyond the legal requirement; for whether a firm provides financial support for cultural, sports, and recreational expenses; for whether the firm provides a work leisure program; and for whether the firm provides financial support for commuting expenses.

We also examine the effect of being a multinational firm on having female managers and having specific human resource policies that may be helpful to female employees. Our primary variable here measures whether or not the firm in the WPS sample was a majority-owned multinational affiliate. We also examine the effect of being majority-owned by diffuse foreign shareholders but controlled and managed by a Korean owner-manager.

We then utilize the second panel data set, which comes from the Korea Women's Development Institute (KWDI) and is known as the Female Human Resource Panel Survey (Survey Covering HR Managers). The first wave of this KWDI panel survey was conducted in 2007 and asked companies about their gender demography and gender-related practices as of the end of 2006. The second wave was conducted in 2008 and asked companies about their gender-related demography and gender-related practices as of the end of 2007. At the same time, these survey answers are combined with publicly audited financial data on these firms.

The KWDI company sample was formed by KWDI by examining where the female managers are represented across Korean industries and by firm-level employment size. The KWDI selected a potential company sample of 350 companies to reflect that population distribution.

Because one of our main goals is to look at the causal effect of changes in gender-related demography and gender-related policies, we focus on the subsample of companies present in both the 2007 and 2008 KWDI survey waves. This sample allows us to use company fixed effects in our main models. Furthermore, we focus on the subsample of such companies with complete data on their managerial demography and financial variables. This core subsample for panel analysis consists of 185 companies. (We also have confirmed that this subsample has characteristics quite similar in mean and distribution to the sample of all companies in the KWDI data, including those with incomplete data.)

Because one of our main goals is to see if foreign-owned firms are more likely to hire female managers and derive a performance advantage from that, we therefore make use of the ownership categories defined by KWDI. In particular, we will focus on the foreign-owned companies and their differences from the other non-foreign-owned companies. As in the case of the KLI data, these foreign-owned companies of interest are in fact managerially controlled affiliates of foreign multinationals.

Our main dependent variable of interest is ROA, defined as the ratio of operating profit to total assets. To deal with a few extreme cases, likely involving firms in the process of being reduced in size or

firms in the process of rapidly accumulating assets, we winsorize the ROA data at the 1 and 99 percentiles. Our alternative dependent variable is Operating Margin, defined as operating profit divided by total sales, and then multiplied by 100. Here to, because of a few extreme outliers, likely involving firms in the process of being reduced in size or firms in the process of rapidly accumulating assets, we winsorize the operating margin data at the 1 and 99 percentiles.

The main independent variables involve gender demography and gender-related policy at the firm level. Since this KWDI sample was selected by KWDI contingent on each firm having at least one female manager, we saw that the differentiation among these firms occurred at the yet higher level of upper-middle management—the bujang (general manager) level—than in the overall Korean firm-level population studied by KLI's WPS data set. In the KWDI sample, firms have made more progress than the population as a whole in promoting women to the bujang level, and the relatively progressive companies have made more progress in the years since Lee (2002) showed Samsung to be a relatively progressive domestic company for promoting women initially only to the gwajang position in greater and greater numbers. So our primary independent variable of interest here is the representation of women as bujangs in the firm. In terms of other demographic data, with the KWDI data we can control for the percentage of female new recruits (female sawons) as well as the total female employee percentage of the firm. Then, because we are interested in gender-related policy, especially gender-related policy of ambiguous positive or negative causal significance for firm performance, we examine whether firms have implemented a family nursing holiday or not. (We have seen similar results using the menstruation holiday variable. Other gender policy variables seemed to lack variation or not to predict any significant differences across firms within this KWDI sample, although we are still in an early stage of data analysis.) Key control variables focus on R&D intensity, the log of assets, leverage (measured by total liabilities divided by total assets), and export orientation (exports of merchandise and manufactured products divided by total sales).

4.1. Summary Statistics from the KLI's WPS Data

As seen in the KLI's WPS data set, most Korean firms simply do not have a single female manager during the period of 2005–2007. Fully 60.8 percent of firms in the sample do not have a single mid-level female gwajang, and an even larger 73.5 percent of firms in the sample do not have a single upper-mid-level chajang. In contrast, it is not the case that Korean firms are all-male in their non-managerial workforce. As seen in the same table, the average firm's total workforce is 22.083 percent female with a standard deviation of 19.991 percent.

Among the other variables, one can see some interesting patterns. The average Korean firm is only modestly profitable, with an average ROA of 5.3 percent, which is consistent with the fact that Korea is actually a fairly competitive market environment. At the time, one can see a large variation in company performance across the economy. The average Korean firm spends a relatively small 0.7 percent on R&D and a relatively small 1.1 percent on advertising. The average firm has a relatively moderate percentage of recent recruits, with a few firms even turning over their workers to a very high degree in the course of a given year. As is widely known, Korea has a relatively high percentage of its workforce that is unionized, and Korean firms tend to provide a great deal of benefits, including help with commuting expenses, that go beyond what is required under the law.

4.2. Models and Results from the KLI Data

First, in order to test H1 and H2, we model the existence of management policies and hiring actions that may be considered beneficial to female employees as a function of being a majority-owned multinational affiliate and controlling for R&D intensity, the log of firm assets, leverage, and export intensity. In order to test the importance of being an actual multinational affiliate controlled by foreign management, we contrast that independent variable with one focusing on Korean-controlled firms that

happen to have a majority of their cash-flow rights owned by foreigners. This comparison shows the relative importance of foreign management control.

We find in Table 2-2 that majority-owned multinational affiliates are significantly more likely to have female managers and to have implemented policies and benefits that are believed to be quite beneficial to female employees. For example, by 2007 foreign multinationals are significantly more likely to have a female chajang and bujang in their Korean affiliate than other firms. In contrast, firms that are controlled by Koreans but have a diffused foreign shareholder majority are only slightly more likely to have a female manager. Among the control variables, we find that larger firms and firms with higher R&D intensity were more likely to have at least one female chajang. Furthermore, as seen in Table 2-2, majority-owned multinational affiliates are significantly more likely to have implemented a maternity leave by 2005, and they are significantly more likely to have opened a childcare facility and to provide two different forms of financial support for childcare. Together, these results support the predictions of H1 and H2 by showing that multinationals are significantly more likely than domestic firms to have female managers and to put in place benefits and policies that are believed to be beneficial to female employees' advancement.

Next, we examine the effect of female management on profitability, and we find support for H3 in Table 2-3. A significant percentage of the WPS sample consists of small firms without any professional managers, and as one would expect, the results are perhaps most clear when focusing on the firms with at least three executives. Yet even across the models, a clear pattern emerges showing that having a higher percentage of female chajangs is significantly associated with higher profitability. As seen in the prior table, majority-controlled multinational affiliates are themselves significantly more likely to have female chajangs. While multinational affiliates within the WPS sample are not benefiting any more than domestic firms that have female chajangs, we find that a 10 percent nominal increase in the percentage of female chajangs is associated with a 1 percent nominal increase in ROA. Moreover, while most of the sample does not go above a 10 percent female representation of chajangs, some go much

higher, and one even goes as high as 77.778 percent. Thus we find evidence for H3, namely that higher female representation in management is associated with higher profitability regardless of whether the firm is foreign or domestically owned. In the WPS sample, we checked and found that there is no statistical difference in the incremental returns to profitability from hiring female managers between multinationals and domestics. It is solely the higher intensity at which multinationals employ female managers that gives them an advantage in the WPS sample.

We next perform a set of extra robustness checks. Ono (2007) argued that multinationals in Japan might be going significantly against the grain in terms of not following the seniority-based and lifetime-employment systems of Japanese locals. South Korea and Japan are known to differ on these dimensions, as a large percentage of South Korean firms have increasingly turned to lateral hiring of of managers and the involuntary dismissal of even male managers. We test Ono's (2007) argument for Japan directly in the Korean case and find that multinationals doing business in South Korea are not significantly less likely to be using seniority and are not giving a higher percentage of their workforce an involuntary push out the door. This lack of difference in work practices in the Korean context is largely due to the fact that even a large and growing percentage of Korean local firms have chosen over time to deviate from strict seniority and to move away from the prior Korean version of lifetime employment. Ono (2007) also argues that workers in Japan are less likely to trust their multinational employers and more likely to quit their jobs voluntarily if they have a foreign employer, but we find no such difference between multinationals and locals in South Korea in terms of the number of voluntary leavers after controlling for size or the percentage of voluntary leavers over total leavers. We were also concerned that perhaps the multinationals are simply more technologically savvy and that this was perhaps an omitted factor. Nevertheless, we find as a robustness check that the level of use of computers in the workplace is not an omitted factor and does nothing to affect the results.

4.3. Summary Statistics from the KWDI Data

Next, we proceed to analyze the KWDI data, where as was previously stated all firms have at least one female manager. What this also means for the sample is that firms are typically larger and more profitable. As shown in Table 2-4, the average firm in the KWDI sample has natural log value of assets of 18.555 and a 6.7 percent ROA, which are both significantly higher than in the WPS sample which include many mom-and-pop businesses. Also, as would be expected given the screening criteria for the KWDI sample, firms in this sample differentiate themselves by having introduced the concept of having women in the next-higher level of upper-middle management, that of bujang. The average firm has 6 percent women among its bujangs with a standard deviation of 14.4 percent. At least one firm has fully 100 percent women among its bujangs.

4.4. Models and Results from the KWDI Data

Next, we proceed to find further support for H1 in the KWDI sample. We find that the average difference between domestic firms and foreign-owned firms in Fiscal Year 2006 is that the percentage of female bujangs is 10.8 nominal percentage points higher. In Fiscal Year 2007, that number actually grows to 13.2 nominal percentage points higher.

We find that this significantly higher representation of female bujangs is associated with high profitability, which provides further confirmation for H3. Using the information from the ROA models 3-8 one sees that a 10 percent higher nominal representation of female bujangs is associated with between 1.57 and 1.84 higher nominal ROA. In our opinion, this is both an economically meaningful increase in profitability, but also one that is realistic given that most firms in Korea completely shut out half of the labor talent pool from management and given that even among the firms in the KWDI sample most are shutting out females entirely from all but the gwajang and chajang levels. Leaving out so much of the labor talent pool from management can logically impact profitability by at least a nominal ROA point or

two, as we in fact find. Also, as seen at the end of Table 6, firms with a higher representation of female bujangs typically also have significantly higher operating margins measured using sales.

Next, we turn once more to examining whether multinationals in this sample of larger firms are in fact gaining some kind of competitive advantage from having female senior managers. By taking the multinationals and domestic firms at their group means and then multiplying the gender-related coefficients from Model 6 of Table 2-6, we next find that at least within the sample of KWDI firms in which all firms have at least one female manager, the multinationals are gaining more competitive advantage than are the domestic firms. As seen in Table 2-7, the gender composition of the average multinational is associated with a 4.0 positive increase in nominal ROA, whereas the gender composition of the average domestic firm is associated with a 2.1 percent increase in nominal ROA.[27] Thus, we conclude from this that at least among the larger firms that are seen to be in the market for hiring and promoting female managers, multinationals are hiring and/or promoting a higher percentage to the bujang level and are reaping a 1.9 percent nominal ROA advantage directly from doing so.

4.5. Multinationals and Strategic Action

We next sought to examine whether even multinationals from a home market that heavily discriminates against women were acting any differently in South Korea. The first group that comes to mind is the significant number of Japanese multinationals. Therefore, utilizing the sample, we examined these Japanese multinationals' managerial demography back in Japan. Those data come from a comprehensive examination by year of the Shikihou annual handbook on Japanese corporate demography, along with a comprehensive review of all sample company websites and annual reports. Among the companies in the KWDI panel, which are by design those among the active set in Korea in terms of hiring

[27] Model 7 of Table 6, while complicated because it introduces multiple interaction terms simultaneously and because those interaction terms have some collinearity and go in different directions, in turn is found to show that the ROA gains go disproportionately to multinationals that simultaneously and fully "walk the walk and talk the talk." In other words, those foreign multinationals whose policies become more supportive of work-family balance and that at the same time hire more female managers enjoy the biggest ROA gains.

female managers, we find it quite striking that none of the Japanese multinationals had a single female executive in Japan during the sample time period. For those that reported their female percentage of total managers, all but one had less than a five percent rate of female managers. In contrast, all of them had at least one female gwajang during the sample time period, and their female percentage of total gwajangs in Korea often was relatively high (even approaching 41 percent in one case). All but one had at least one female chajang, with the female percentage of total chajangs reaching as high as 36 percent.[28]

We then also examine the Japanese companies in the KLI data set and found that while there is much more subsample heterogeneity in female hiring, there too one sees a large number of Japanese multinationals that act one way in Japan and another way in South Korea. Among the Japanese companies in the KLI sample, only one is seen to have even a single female executive back in Japan. Their female percentage of total managers, for those that reported it, is almost invariably in the low single digits. Yet several of them have a female executive in South Korea, and a significant minority have at least one gwajang or one chajang over the sample time period, and it is not terribly uncommon to see a Japanese company with a double-digit percentage of females among their gwajangs or chajangs.

In summary, our examination of the Japanese multinationals suggests that many firms are acting strategically (by having a significantly different demography between Korea and Japan). Yet others have chosen not to have a single female manager. On the one hand, we are restricted by the rules of KWDI and KLI data access from being able to present any piece of data that could potentially lead to the identification of a firm in the KWDI or KLI sample, but we instead attempted to contact female managers

[28] It is interesting to note the contrast between our results and those of Wu, Lawler, and Yi (2008), who presented data on job recruitment advertisements by multinationals in Thailand and Taiwan during 1993-1999. Wu, Lawler, and Yi (2008) found that multinationals from countries with strong anti-discrimination laws on the books were less likely to overtly discriminate by gender in job ads. Perhaps Japanese multinationals doing business in Taiwan and Thailand were sometimes so overtly bigoted in the 1990s, as Wu, Lawler, and Yi (2008) indicated, but had learned by the 2000s to seize the strategic opportunity of hiring talent female managers. Indeed, among the Japanese multinationals we visited, the ones that had senior female managers had often first hired and/or promoted them in the 2000s, which suggested learning effects and/or changes in their view towards the idea of having women as managers in their Korean subsidiaries.

at Japanese companies in Seoul listed in the old Ministry of Commerce, Industry and Energy database of inward foreign direct investors via alumni networks we were acquainted with through prior research projects in Korea. We did find evidence of some Japanese firms that discriminated heavily against Korean women and some that gave clear opportunities based on performance. Among the ones that discriminated heavily, we were told the stories of women passing actual internal company examinations for promotion and then being denied the promotion because the men's military service was counted as a positive. The following quote from a female managerial-track employee at a Japanese consumer-products company was representative of the wider set: "Because we know and don't think it's possible for us to change the organization and the way of thinking of our CEO, what we do is sometimes we get together and talk about how conservative and how unfair things are in our company; but we don't think it is possible to change our company" (Interview with first author, January 30, 2010).

In contrast, a senior Korean female manager at a Japanese financial firm in Seoul whom we interviewed stated, "There is no senior female manager at headquarters in Japan, but I think they are more open-minded with the overseas subsidiary because they know that Korea is different from Japan and they need the high-performance employee in a foreign market whenever they can find one. I received the highest evaluation from amongst my team, and I think that is why my boss trusts me" (interview with the first author, October 26, 2009). Our overall conclusion is that discrimination occurs based on a combination of beliefs about the efficiency of homogeneous male leadership teams and social expectations and obligations within male executive networks. When Japanese multinationals go to South Korea, most carry the beliefs with them, although as our quote suggests some are willing to see that Korea is different from Japan and may require different practices to be successful. But perhaps more importantly, the Japanese multinationals do not have the same male social network expectations and obligations when they are in South Korea, and this may open up opportunity to form alliances with women. So, in summary, our conclusion from the qualitative and quantitative data is that there is a bifurcation in which some Japanese multinationals continue to discriminate against women just as they do

at headquarters but that others act in a markedly different way based importantly on strategic opportunity and not any form of charity or social preference.

The other multinationals across our KWDI and KLI samples are primarily from Western Europe or the United States, and they demonstrate signs of strategic behavior in their hiring and promotion decisions as well. We conducted a comprehensive seven-month-long effort to collect data on senior management demography across our combined KWDI and KLI samples by thoroughly examining all sample company websites and available annual reports. We also found the Thomson One Banker, Capital IQ, Execucomp, and LexisNexis databases to be particularly useful sources of data on executive demography, with the Execucomp database being focused on large U.S. multinationals but the other databases having annual reports and/or direct listings of executive demography data on European and American multinationals. For completeness, we analyzed all multinationals that were surveyed by KLI or KWDI, even though some had incomplete information on our quantitative variables and thus did not make it onto the panel analyses. To be clear, we see substantively identical results on multinationals' strategic behavior with or without this inclusion rule. The results of this lengthy data collection effort are presented in Table 8. Among the European multinationals across our KWDI and KLI data sets, 35 of 36 from Year 2005 have available data on their home-market executive teams. Of these 35, nearly two-thirds (20) have not a single female executive at home. From year 2007, all 53 have data on their home-market executive teams during the sample time period. Of these 53, 33 do not have a single female executive. The American multinationals, while more frequently having at least one senior female executive, still often lack a significant representation of women in their senior executive teams. Among the American multinationals across our KWDI and KLI data sets, 48 of 50 have data for Year 2005 on their home-market executive team. Of those 48, 36 of them do not have a single woman represented among their CEO, Chairman, COO, CFO, head of HR, or chief legal officer. For Year 2007, 55 of 56 have data for Year 2007 on their home-market executive team. Of those 55, 38 do not have a single woman represented among their CEO, Chairman, COO, CFO, head of HR, or chief legal officer. Of

those 38 that did not have a single woman represented among their senior-most executives, 17 do not have a single woman listed among even their other senior managers in their annual reports. We also proceed to test statistically whether the hiring and promotion of women in South Korea is merely being driven by hiring and promotion at headquarters. In fact, there is no statistically significant correlation among either European or American multinationals. This is consistent with our overall finding that neither hiring/promotion practices at headquarters nor universal global policies set at headquarters were dictating practice in South Korea. Instead, we find through our interviews that multinationals were making strategic choices on the ground in South Korea.

As a final note for this section, some readers have asked whether home-country laws require that multinationals not discriminate against Korean women. Interestingly enough, the U.S. Congress, in putting antidiscrimination laws into effect, explicitly stated that foreign citizens employed abroad enjoy none of the law's protections (Equal Employment Opportunity Commission, 2003; Gentry, Locke, Rakes, and Moore, 2006). We are not aware of any extraterritoriality of Western European countries' laws that extends legal antidiscrimination statutes to the employment of foreign citizens in foreign subsidiaries.

5. Discussion and Conclusion

Our results indicate that multinationals in the representative emerging economy of South Korea enjoy a competitive weapon from their active hiring and promotion of the excluded group in the labor market. The size of the profit benefit is large but realistic. The market is moving towards a new equilibrium that is free of discrimination, but only at a very slow rate. Thus, the profits are not being quickly competed away.

We have found that all firms, both foreign-owned and domestically-owned, were able to enjoy a performance benefit through increased hiring of women, especially at the senior management level. We see support for that even in the KWDI panel sample, which is particularly interesting given that the

KWDI sample design meant that the companies in the sample had more female managers on average than the Korean firm-level population as a whole. Thus, even for a sample with somewhat higher-than-typical female representation, the increased hiring of women, particularly at senior management levels, is associated with an increase in profitability. It is important to note that all of our profitability models make use of firm-level fixed effects and therefore automatically control for industry affiliation and all other fixed characteristics of each individual company. Interestingly, although all types of firms can derive a benefit from increased hiring of women, the foreign firms in the KWDI sample apparently take greater advantage of this competitive opportunity than do the domestically-owned firms. Finally, it is interesting that this KWDI sample shows that women can have a positive effect on performance especially when they get to yet higher levels of management than in prior surveys. This is notable, given that other surveys capture the hiring of female managers at an earlier stage. It is notable that firms that are further along in their hiring and promotion of female senior managers derive yet further performance benefits from doing so.

Taking our results seriously means rethinking the liability of foreignness and the prior organizational theory literature's focus on the immense difficulty for the multinational of being pushed in multiple directions by oftentimes conflicting institutions, norms, and pressures across the markets in which the multinational operates. While the difficulty is real, one of the coauthors has shown through a natural experiment in prior research that a representative large U.S. multinational used flexible intermediate adaption to overcome the overwhelming percentage (over 75 percent) of the institutional distance (Siegel and Larson, 2009). Managerial creativity and learning through error and self-experience is likely essential for overcoming the institutional distance. In the case of Lincoln Electric, it took some years for several of the subsidiaries to land on the most efficient combination of practices for each unique labor market.

Multinationals can in this study be viewed as social deviants, since they actively break still-often-dominant local norms holding that men are more appropriately suited for corporate management roles and

that male homeogeneity in leadership teams is socially preferred. The deviance literature cannot agree on a definition of deviance (see the literature survey in Clinard and Meier, 2008: 2), but one definition states that deviance is about breaking the dominant group's norms (Pfohl, 1994). Also, one textbook states that hiring women for jobs previously considered to be the province of men is a form of social deviance (Anleu, 1991: 1). As seen in our study, many multinationals are actively, even aggressively, breaking the dominant group's norms regarding female leadership. Usually one thinks of NGOs and ad hoc consumer groups as market rebels challenging dominant local norms, but in our study it is the foreign multinationals who are the "rebels" (Rao, 2009). Through social deviance, multinationals are themselves becoming instruments of social change and increased opportunity for the excluded group, namely women.

This study goes yet further in showing that sometimes being an alien to the local social networks can be an advantage. There is an extraordinary opportunity that comes from being able to start fresh, free from bias and prior commitment to competing interests, and being able to in effect form a new coalition that leverages the underutilized talent pool among the excluded social group.

This is much like in democracy, where rising parties in democratization processes often appeal to the excluded group to join their coalition and fight for expanded political rights. From Brazil (Martínez-Fritscher, Musacchio, and Viarengo, 2010) to Japan (Ramseyer and Rosenbluth, 1995), fissures among elites often led to a breakdown of the political or economic cartel and the expansion of opportunities for the then-excluded group. In Brazil during 1889–1930, an oligarchic political structure became more democratic as competition within the oligarchy led some entrepreneurial politicians to expand educational opportunity in their states. Since voting rights were based at that time in Brazil on proven literacy, these entrepreneurial politicians predicted correctly that the newly literate citizens would demonstrate some gratitude for their newfound opportunity and vote the entrepreneurial politicians into power (Martínez-Fritscher, Musaccio, and Viarengo, 2010). In Japan during 1868–1881, the cartel among the oligarchs broke down when they failed to collude and divide up power without infighting. As a result, some oligarchs sought to expand political rights to the excluded so as to defeat their own elite adversaries. As

Ramseyer and Rosenbluth (1995: 15) argue, "It was this jockeying for power among themselves and bringing in support from outside the circle that destroyed the oligarchy's exclusive control of Japan's political system."

The critical condition for the elite cartel to unravel seems to be that there are at least some rival networks and rival identities within the elite structure, such they don't all trust each other to preserve agreements and/or that one network seeks to be wealthier *in relative terms* when compared to another network. When such social fissures exist among the male elites, as they clearly do in South Korea (Siegel, 2007), the cartel will not endure as soon as it becomes easier to form initial coalitions by hiring one or a few members of the excluded group without much public attention (as has occurred more often in recent years in South Korea), and/or as soon as the excluded group has more education and other popular legitimacy to offer to the male elites offering them a coalition partnership, and as soon as it becomes socially and economically damaging to firms and the male elites that control them to be publicly seen as bigots punishing those who provide opportunities to women.

While the South Korean market is converging towards a new equilibrium of reduced discrimination in the managerial labor market, the convergence is quite slow in its progress. While one could argue that this study shows the victory of markets for reducing discrimination, we are more likely to see the glass half empty. Because the ideology around the efficiency benefits of homogeneity is so widely taught and so widely accepted by the society, only a small percentage of firms have experimented with hiring the excluded group. While multinational entrants have speeded the process along, there are simply too few of them in relation to the national population of organizations to have a rapid impact on the economy as a whole. This slow convergence, ironically enough, is what is giving the foreign multinationals a key opportunity for gaining competitive advantage in the Korean market over the long term. So one is left with a slowly emerging equilibrium in which foreign multinationals gain competitive advantage but the economy is still sufficiently divorced from the competitive effect for there to be massive societal changes. Perhaps the revealed facts from this study on the competitive advantage being

ceded to foreigners will have some societal effect, although we would not make a particularly large financial bet on that side of the ledger given the persistent influence of the reigning ideology of male supremacy among a nontrivial percentage of senior elites.

The limitation of our study of course is that it is based in a single focal labor market (although it compares actions of the same actors in their home markets to their actions in the focal labor market), but we would nevertheless predict the following logical necessary conditions and boundary conditions for our results. In terms of necessary conditions, we think there is one: the education system has to be more open to the excluded group than the labor market. Of course, if the excluded group does not even have access to education, then hiring the excluded group into positions of management is not likely going to aid performance. We, however, do not see this as a highly restrictive condition, since most states and even most emerging economies have made enormous progress in at least opening up their educational system to the excluded group in the labor market (Ramirez, 1987; Bradley and Ramirez, 1996; Meyer et al., 1997). In terms of boundary conditions, we think the performance benefits may be restricted to countries where only a small percentage of firms have more than a tokenistic representation of female managers. Here too, our predicted boundary condition would still leave most emerging economies in the possible set for competitive advantage, but it may potentially exclude a limited set of countries such as the U.S. where women at least more often play a senior management role (while not a top-five executive role) in a large percentage of firms. The point is not that women don't face inequity in the U.S., as they clearly do; the point instead is that competitive differentiation occurs primarily when the majority of firms lack even a single female senior manager and the differentiators are able to fill their senior management ranks with a number of underutilized, talented women. Future work will of course be needed to test these predictions.

This study has been about identifying the existence of a net benefit to the employment of female management despite the tradeoff of an uncertain negative counter-reaction from many regulators, customers, business partners, and/or male employees. We believe in considerably causality, since the primary forms of unobserved heterogeneity and endogeneity—the public relations counterhypothesis and

the law-enforcement-is-tougher-on-more-profitable-firms counterhypothesis—simply do not apply to South Korea. This is a situation of uncertainty in which a likely benefit of moderately uncertain size empirically outweighs a pushback of highly uncertain size. As Goodrick and Salancik (1996) point out, it is precisely in a situation of moderate uncertainty that there is room for managerial discretion to experiment.

That is indeed what we see in the data. There is experimentation being done that leads to learning that there is a positive net effect, which in turn leads to more employment of female managers. Because of the crucial role of historical beliefs and of uncertainty about current-period changes in the social backlash to female leaders, the choice to employ female managers is highly exogenous and a form of early-stage experimentation in the sample. We do therefore believe that employing more and more female manager led to higher profitability in the sample.

We, however, at the same time believe in some real limits to the causality, in a way that is analogous to the work of Ichniowski and Shaw (2003) on human resource practices in U.S. steel plants. Specifically, it is quite possible that some firms not employing female managers would potentially face such high transition costs in the form of male employees staging a kind of counter-insurgency or pushback from regulators, customers, and/or business associates that the perceived adjustment costs do rationally prevent some from increasing their representation of women. Yet for a significant percentage of such firms, the perceived transition costs may be based more on collective and broadly held beliefs about what might happen rather than the result of evidentiary-based experimentation. We do think there would likely be a significant percentage of firms who could benefit from increased female representation if only they would engage in such evidentiary-based experimentation within their own firms. Of course, such experimentation and its ultimate outcome are an empirical question. Yet what we do know is that the Korean economy as a whole appears to be losing significant amounts of economic advantage to foreign multinationals as the overwhelming majority of Korean firms continue to exclude women entirely from management. Also, it is important to note that showing a net benefit to the employment of female

management shows that the benefits outweigh the clear drawbacks on average, but it does not intend to, and is not able to with the current data, decompose the possibly multiple parts of the benefits part of the equation. That is something we hope to do in a future study if we can collect the necessary data to do such a decomposition of the benefits.

In conclusion, we have presented evidence for the existence of a competitive advantage based on foreigners exploiting the social divide in the host market. This competitive advantage, while not unique to foreigners, is more likely to be perceived by foreigners who are alien to the local social network, can easily perceive the most major and significant social schisms, and can exploit the market failure where the excluded group is talented but underutilized. This competitive advantage is shown to be associated with a significant profit benefit, and one that is only very slowly being competed away through imitation. Two decades ago, Castanias and Helfat (1991) called for research on how managerial resources can lead to inimitable competitive advantage. This study also attempts to answer that call for how firms can build sustainable competitive advantage through their actions in the labor market.

References

Adler, Nancy J. 1993."Competitive Frontiers: Women Managers in the Triad." *International Studies of Management and Organization* 23:3–23.

Aguilera, Ruth V. 1998. "Elites, Corporations and the Wealth of Nations: Historical Institutional Patters in Italy and Spain." Ph.D. Dissertation, Department of Sociology, Harvard University,

Anleu, Sharyn L. Roach. 1991. *Deviance, Conformity and Control.* Melbourne: Longman Cheshire,

Appold, Stephen J., Sununta Siengthai, and John D. Kasarda. 1998. "The Employment of Women Managers and Professionals in an Emerging Economy: Gender Inequality as an Organizational Practice." *Administrative Science Quarterly* 43:538–565.

Arrow, Kenneth J. 1972. "Models of Job Discrimination." In Anthony H. Pascal, ed., *Racial Discrimination in Economic Life.* Lexington, Mass.: Lexington Books.

Arrow, Kenneth J. 1973. "The Theory of Discrimination." In Orley Ashenfelter and Albert Rees, eds., *Discrimination in Labor Markets.* Princeton, NJ: Princeton University Press.

Ashenfelter, Orley, and Timothy Hannan. 1986. "Sex Discrimination and Product Market Competition: The Case of the Banking Industry." *Quarterly Journal of Economics* 101:149–174.

Becker, Gary. 1957/1971. *The Economics of Discrimination.* 2nd Edition. Chicago: University of Chicago Press.

Biggart, Nicole W., and Mauro F. Guillén. 1999. "Developing Difference: Social Organization and the Rise of the Auto Industries of South Korea, Taiwan, Spain, and Argentina." *American Sociological Review* 64:722–747.

Black, Sandra E., and Elizabeth Brainerd. 2004. "Importing Equality? The Impact of Globalization on Gender Discrimination." *Industrial and Labor Relations Review* 57:540–559.

Blau, Peter M. 1977. *Inequality and Heterogeneity: A Primitive Theory of Social Structure.* New York: Free Press.

Bradley, Karen, and Francisco O. Ramirez. "World Polity Promotion of Gender Parity: Women's Share of Higher Education, 1965–85." *Research in Sociology of Education and Socialization* 11: 63–91.

Brinton, Mary C. 1989. "Gender Stratification in Contemporary Urban Japan." *American Sociological Review* 54:549–564.

Brinton, Mary C. 1993. *Women and the Japanese Miracle.* Berkeley: University of California Press.

Brinton, Mary C. 2001. "Married Women's Labor in East Asian Economies." In Mary C. Brinton, ed., *Women's Working Lives in East Asia.* Stanford: Stanford University Press.

Brinton, Mary C. 2007. "Gendered Offices: A Comparative-Historical Examination of Clerical Work in Japan and the United States." In Frances McCall Rosenbluth, ed., *The Political Economy of Japan's Low Fertility.* Stanford: Stanford University Press.

Castanias, Richard P., and Constance E. Helfat. 1991. "Managerial Resources and Rents." *Journal of Management* 17:155–171.

Cho, Haejoang. 2000. "Male Dominance and Mother Power: The Two Sides of Confucian Patriarchy in Korea." In Walter H. Slote and George A. De Vos, eds., *Confucianism and the Family*. Albany: State University of New York Press.

Clinard, Marshall B., and Robert F. Meier. *Sociology of Deviant Behavior*. Belmont, CA: Thomson Wadsworth.

Desvaux, Georges, Sandrine Devillard-Hoellinger, and Mary C. Meaney. 2008. "A Business Case for Women." *McKinsey Quarterly*, September, 26–33.

Deszo, Christian, and David Ross. 2009. "Girl Power: Female Participation in Top Management and Firm Performance." Working Paper. New York: Columbia Business School.

Deszo, Christian, and David Ross. "Does Female Representation in Top Management Improve Firm Performance? A Panel Data Investigation." *Strategic Management Journal* forthcoming.

Deuchler, Martina. 1992. *The Confucian Transformation of Korea: A Study of Society and Ideology*. Cambridge, Mass.: Harvard University Press.

Deuchler, Martina. 2003. "Propagating Female Virtues in Chosŏn Korea." In Dorothy Ko, JaHyun Kim Haboush, and Joan R. Piggott, eds., *Women and Confucian Cultures in Premodern China, Korean, and Japan*. Berkeley: University of California Press.

Duncan, John. 2000. "The Korean Adoption of Neo-Confucianism: The Social Context." In Walter H. Slote and George A. De Vos, eds., *Confucianism and the Family*. Albany: State University of New York Press.

Eagly, Alice H., and Linda L. Carli. 2007. *Through the Labyrinth: The Truth About How Women Become Leaders*. Boston: Harvard Business School Press.

Edman, Jesper. 2009. "The Paradox of Foreignness." Unpublished Ph.D. dissertation. Stockholm: Stockholm School of Economics.

Equal Employment Opportunity Commission. "Enforcement Guidance on Application of Title VII and the Americans with Disabilities Act to Conduct Overseas and to Foreign Employers Discriminating in the United States." Notice 915.002, issued October 20, 1993. Downloaded from http://www.eeoc.gov/policy/docs/extraterritorial-vii-ada.html on December 28, 2010.

Estévez-Abe, Margarita. 2007. "Gendering the Varieties of Capitalism: Gender Bias in Skills and Social Policies." In Frances McCall Rosenbluth, ed., *The Political Economy of Japan's Low Fertility*. Stanford: Stanford University Press.

Gentry, Locke, Rakes, and Moore. "Application of U.S. Employment Laws to Workers Employed Abroad." An employment law firm's legal statement, issued on November 21, 2006. Downloaded from http://www.gentrylocke.com/showarticle.aspx?Show=242 on December 28, 2010.

Ghoshal, Sumantra, and D. Eleanor Westney. 1992. *Organization Theory and the Multinational Corporation*. London: Macmillan.

Goodrick, Elizabeth, and Gerald R. Salancik. 1996. "Organizational Discretion in Responding to Institutional Practices: Hospitals and Cesarean Births." *Administrative Science Quarterly* 41:1–28.

Guillén, Mauro F. 1994. *Models of Management: Work, Authority, and Organization in a Comparative Perspective*. Chicago: The University of Chicago Press.

Guillén, Mauro F. 2000. "Corporate Governance and Globalization: Is There Convergence Across Countries?" *Advances in International Comparative Management* 13:175–204.

Guillén, Mauro F. 2001. *The Limits of Convergence: Globalization and Organizational Change in Argentina, South Korea, and Spain*. Princeton: Princeton University Press.

Guler, Isin, Mauro F. Guillén, and John Muir Macpherson. 2002. "Global Competition, Institutions, and the Diffusion of Organizational Practices: The International Spread of ISO 9000 Quality Certificates." *Administrative Science Quarterly* 47: 207–232.

Hall, David L., and Roger T. Ames. 2000. "Sexism, with Chinese Characteristics." In Chenyang Li, ed., *The Sage and the Second Sex: Confucianism, Ethics, and Gender*. Chicago: Open Court.

Hamilton, Gary G., and Nicole W. Biggart. 1988. "Market, Culture, and Authority: A Comparative Analysis of Management and Organization in the Far East." *American Journal of Sociology* 94: S52–S94.

Hellerstein, Judith K., and David Neumark. 1999. "Sex, Wages, and Productivity: An Empirical Analysis of Israeli Firm-Level Data." *International Economic Review* 40: 95–123.

Hellerstein, Judith K., David Neumark, and Kenneth R. Troske. 1999. "Wages, Productivity, and Worker Characteristics: Evidence from Plant-Level Production Functions and Wage Equations." *Journal of Labor Economics* 17: 409–446.

Hellerstein, Judith K., David Neumark, and Kenneth R. Troske. 2002. "Market Forces and Sex Discrimination." *Journal of Human Resources* 37: 353–380.

Hewlett, Sylvia Ann, and Ripa Rashid. 2010. "The Battle for Female Talent in Emerging Markets." *Harvard Business Review* 88:101–106.

Houseman, Susan N., and Katharine G. Abraham. 1993. "Female Workers as a Buffer in the Japanese Economy." *American Economic Association Papers and Proceedings* 83: 45–51.

Hymer, Stephen. 1960/1976. *The International Operations of National Firms: A Study of Direct Foreign Investment*. Cambridge, Mass.: MIT Press.

Ichniowski, Casey, and Kathryn Shaw. 2003. "Beyond Incentive Pay: Insiders' Estimates of the Value of Complementary Human Resource Management Practices." *Journal of Economic Perspectives* 17:155–180.

ILO Department of Statistics. *"Laborsta Internet"*. Accessed on December 12, 2010 at http://laborsta.ilo.org/.

Janelli, Roger L. (with Dawnhee Yim). 1993. *Making Capitalism: The Social and Cultural Construction of a South Korean Conglomerate*. Stanford: Stanford University Press.

Jepperson, Ronald L., and John W. Meyer. 1991. "The Public Order and the Construction of Formal Organizations." In Walter W. Powell and Paul J. DiMaggio, eds., *The New Institutionalism in Organizational Analysis*. Chicago: University of Chicago Press.

Kawaguchi, Daiji. 2007. "A Market Test for Sex Discrimination: Evidence from Japanese Firm-Level Data." *International Journal of Industrial Organization* 25: 441–460.

Kearney, Robert P. 1991. The Warrior Worker: The Challenge of the Korean Way of Working. New York: Henry Holt and Company.

King, Elizabeth M., and Andrew D. Mason. 2001. *"Engendering Development – Through Gender Equality in Rights, Resources and Voice."* The World Bank Group.

Lee, Joohee. 2002. "Shattering the Glass Ceiling? Successful Gender-Sensitive Human Resource Strategies." Working Paper.

Lee, Suh-Hyun. "Male-Oriented Court Starts to Realize the Importance of Maternity Issues." DongA Daily (Internet Edition), February 17, 2010, accessed at http://news.donga.com/3/all/20100217/26222753/1 on August 4, 2010.

Li, Chenyang. 2000. "Introduction: Can Confucianism Come to Terms with Feminism." In Chenyang Li, ed., *The Sage and the Second Sex: Confucianism, Ethics, and Gender*. Chicago: Open Court.

Martínez-Fritscher, André, Aldo Musacchio, and Martina Viarengo. 2010. "The Great Leap Forward: The Political Economy of Education in Brazil." Working Paper. Boston: Harvard Business School,

Meyer, John W., John Boli, George M. Thomas, and Francisco O. Ramirez. 1997. "World Society and the Nation State." *American Journal of Sociology* 103:144–181.

Meyer, John W., and Brian Rowan. 1977. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83: 340–363.

Meyer, John W., and W. Richard Scott. 1983. *Organizational Environments: Ritual and Rationality*. Beverly Hills, Cal.: Sage.

Mezias, John. 2002. "How to Identify Liabilities of Foreignness and Assess Their Effects on Multinational Corporations." *Journal of International Management* 8:265–283.

Morgan, Glenn, Peer Hull Kristensen, and Richard Whitley. 2001. *The Multinational Firm: Organizing Across Institutional and National Divides*. Oxford: Oxford University Press.

Morrisson, Christian, and Johannes Jütting. 2004. *"The Impact of Social Institutions on the Economic Role of Women in Developing Countries."* Working Paper, No. 234. OECD Development Centre.

Mun, Eunmi. 2010. "Sex-Typing of Jobs in Hiring: Evidence from Japan." Working Paper. Cambridge: Department of Sociology, Harvard University.

Nachum, Lilach. 2003. "Liability of Foreignness in Global Competition? Financial Service Affiliates in the City of London." *Strategic Management Journal* 24:1187–1208.

Nielsen, Francois. 1985. "Toward a Theory of Ethnic Solidarity in Modern Societies." *American Sociological Review* 50: 133–149.

Ono, Hiroshi. 2007. "Careers in Foreign-Owned Firms in Japan." *American Sociological Review* 72:267–290.

Ono, Hiroshi. 2010. "Free Agents in an Embedded World: Career Mobility in the Japanese Financial Sector." Working Paper. College Station: Texas A&M University.

Ono, Hiroshi, and Kazuhiko Odaki. "Foreign Ownership, Human Capital, and the Structure of Wages in Japan." *International Journal of Human Resource Management* 2011 forthcoming.

Ono, Hiroshi, and Nicola Piper. 2004. "Japanese Women Studying Abroad, The Case of the United States." *Women's Studies International Forum* 27:101–118.

O'Reilly, Charles A., David F. Caldwell, and William P. Barnett. 1989. "Work Group Demography, Social Integration, and Turnover." *Administrative Science Quarterly* 34:21–37.

Orrú, Marco, Nicole W. Biggart, and Gary G. Hamilton. 1997. *The Economic Organization of East Asian Capitalism.* Thousand Oaks, Cal.: Sage Publications.

Pfohl, Stephen J. 1994. *Images of Deviance and Social Control: A Sociological History.* Second Edition. New York: McGraw-Hill.

Phillips, Damon, and Ezra Zuckerman. 2001. "Middle-Status Conformity: Theoretical Restatement and Empirical Demonstration in Two Markets." *American Journal of Sociology* 107: 379–429.

Powell, Gary N., D. Anthony Butterfield, and Jane D. Parent. 2002. "Gender and Managerial Stereotypes: Have the Times Changes?" *Journal of Management* 28: 177–193.

Ramirez, Francisco O. 1987. "Global Changes, World Myths, and the Demise of Cultural Gender." In Terry Boswell and Albert J. Bergesen, eds., *America's Changing Role in the World-System.* New York: Praeger/

Ramseyer, J. Mark, and Frances M. Rosenbluth. 1995. *The Politics of Oligarchy: Institutional Choice in Imperial Japan.* Cambridge: Cambridge University Press.

Rao, Hayagreeva. 2009. *Market Rebels: How Activists Make or Break Radical Innovations.* Princeton: Princeton University Press.

Rosenbluth, Frances McCall. 2007. "The Political Economy of Low Fertility." In Frances McCall Rosenbluth, ed., *The Political Economy of Japan's Low Fertility.* Stanford: Stanford University Press.

Rosenzweig, Philip M., and Nitin Nohria. 1994. "Influences on Human Resource Management Practices in Multinational Corporations." *Journal of International Business Studies* 25: 229–251.

Rosenzweig, Philip M., and Jitendra V. Singh. 1991. "Organizational Environments and the Multinational Enterprise." *Academy of Management Review* 16: 340–361.

Sara-Lafosse, Violeta. 1998. "Machismo in America Latina and the Caribbean." In Nelly P. Stromquist, ed., *Women in the Third World: An Encyclopedia of Contemporary Issues.* New York: Garland Publishing.

Siegel, Jordan I. 2007. "Contingent Political Capital and International Alliances: Evidence from South Korea." *Administrative Science Quarterly* 43: 538–565.

Siegel, Jordan I., and Barbara Larson. "Labor Market Institutions and Global Strategic Adaptation: Evidence from Lincoln Electric." *Management Science* 55 (2009): 1527–1546.

Siegel, Jordan I., Amir Licht, and Shalom Schwartz. "Egalitarianism and International Investment." *Journal of Financial Economics* 2011 forthcoming.

Shirahase, Sawako. 2007. "Women's Economic Status and Fertility: Japan in Cross-National Persepctive." In Frances McCall Rosenbluth, ed., *The Political Economy of Japan's Low Fertility*. Stanford: Stanford University Press.

Slote, Walter H., and George A. De Vos. 2000. (Eds.) *Confucianism and the Family*. Albany: State University of New York Press.

Smith, Nina, Valdemar Smith, and Mette Verner. "Do Women In Top Management Affect Firm Performance? A Panel Study of 2500 Danish Firms." IZA Discussion Paper No. 1708, August 2005.

Tu, Wei-Ming. "Confucius and Confucianism." 2000. In Walter H. Slote and George A. De Vos, eds., *Confucianism and the Family*. Albany: State University of New York Press.

Szymanski, Stefan. 2000. "A Market Test for Discrimination in the English Professional Soccer Leagues." *Journal of Political Economy* 108:590–603.

United Nations Statistics Division. *"UN Data."* Accessed at http://unstats.un.org/unsd/demographic/products/indwm/default.htm on December 12, 2010.

Watkins, Kevin. 2007. *"Human Development Report 2007/2008, Fighting Climate Change: Human Solidarity in a Divided World."* Published for the United Nations Development Programme (UNDP).

Wu, Cindy, John J. Lawler, and Xiang Yi. 2008. "Overt Employment Discrimination in MNC Affiliates: Home-Country Cultural and Institutional Effects." *Journal of International Business Studies* 39:772–794.

Zaheer, Srilata. 1995. "Overcoming the Liability of Foreignness." *Academy of Management Journal* 38:341–363.

Tables

Table 1. Summary Statistics Using the WPS Data						
Variable	Mean	Std Dev	Median	Min	Max	Obs
ROA (equal to Operating Profit/Total Assets and winsorized at the 1 and 99 percentiles)	0.053	0.078	0.049	-0.479	0.333	934
Female Chajang Percent	2.576	8.045	0.000	0.000	77.778	934
Female Gwajang Percent	5.023	10.243	0.000	0.000	71.429	934
At Least One Female Chajang	0.225	0.418	0.000	0.000	1.000	934
At Least One Female Gwajang	0.392	0.488	0.000	0.000	1.000	934
Size	11.821	1.741	11.577	4.060	17.233	934
Leverage	1.122	14.593	0.527	0.001	431.724	934
Year is 2005	0.500	0.500	0.500	0.000	1.000	934
R&D Intensity	0.007	0.017	5.22E-05	0.000	0.172	934
Advertising Intensity	0.011	0.039	0.001	0.000	0.950	934
Active Union in the Workplace	0.462	0.488	0.000	0.000	1.000	934
Percent of Newly Recruited Workers	18.756	19.340	13.436	0.000	163.964	934
Percent of Fixed Term Contract Workers	4.803	10.990	0.419	0.000	100.000	934
Support for Healthcare Expenses Provided	0.818	0.382	1.000	0.000	1.000	934
Support for Cultural, Sports, and Recreation Expenses Provided	0.663	0.465	1.000	0.000	1.000	934
Work Leisure Provided	0.619	0.481	1.000	0.000	1.000	934
Support for Commuting Expenses Provided	0.682	0.458	1.000	0.000	1.000	934
Total Female Percent of Employees	22.083	19.991	14.977	0.000	93.789	934
Sample is based on Model 4 of Table 3.						

Table 2. Using WPS Data: Foreign-Owned Firms Are More Likely To Hire Women as Senior Managers

The following table uses the WPS data file and shows the results of cross-sectional regressions in which demographic outcomes and business practices and employee benefits are the dependent variables. The t-statistics appear below the coefficients in brackets.

	At Least One Female Chajang in 2007	At Least One Female Chajang in 2007	At Least One Female Bujang in 2007	Maternity Leave Implemented as of 2005	Workplace Childcare Facility Implemented as of 2007	Support for Childcare Costs Implemented as of 2007	Childcare Support Provided as of 2007
Independent Variable:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Majority-Owned MNC Affiliate	0.152		0.107	0.111	0.054	0.092	0.117
	[2.50]		[2.14]	[1.96]	[2.49]	[1.98]	[2.20]
Majority Owned by Foreign Shareholders but No MNC Management		0.027					
		[3.00]					
controlling for R&D Intensity, log(Assets), Leverage, Export Intensity	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: The t-statistics appear below the coefficients in brackets.

Table 3. Explaining Profitability Using the WPS Data

The following table uses the WPS data and shows the results of fixed effects regressions in which ROA is the main dependent variable. Robust standard errors corrected for clustering at the firm appear below the coefficients in brackets.

	DV: ROA (equal to Operating Profit/Total Assets) and winsorized at the 1 and 99 percentiles							
					Temporarily restricted to companies with at least three executives	Temporarily restricted to companies with at least three executives	Temporarily restricted to companies with at least three executives	Temporarily restricted to companies with at least three executives
Independent Variable:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
Female Chajang Percent		0.001 **		0.001 **		0.001 **		0.001 **
		(5.991E-04)		(5.942E-04)		(6.235E-04)		(6.178E-04)
Female Gwajang Percent		4.093E-04		4.567E-04		0.001		
		(4.974E-04)		(0.001)		(0.001)		
At Least One Female Chajang		-0.011		-0.011				
		(0.009)		(0.009)				
At Least One Female Gwajang		-0.003		4.567E-04				
		(0.008)		(0.001)				
Size	-0.017 **	-0.018 **	-0.017 **	-0.017 **	-0.012	-0.012	-0.012 *	-0.012 *
	(0.008)	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)
Leverage	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***
	(2.222E-04)	(2.231E-04)	(2.097E-04)	(2.095E-04)	(1.204E-04)	(1.197E-04)	(1.091E-04)	(1.086E-04)
Year is 2005	0.007 *	0.007 **	0.005	0.005	0.007 *	0.009 **	0.009 **	0.010 **
	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)
R&D Intensity	1.165	1.148	1.225	1.206	0.108	-0.005	0.001	-0.039
	(0.907)	(0.916)	(0.902)	(0.911)	(0.422)	(0.395)	(0.409)	(0.405)
Advertising Intensity	-0.113 **	-0.116 **	-0.113 **	-0.115 **	-0.101 **	-0.092 **	-0.105 **	-0.096 **
	(0.051)	(0.045)	(0.057)	(0.050)	(0.049)	(0.041)	(0.045)	(0.041)
Active Union in the Workplace	-0.023	-0.024	-0.028 *	-0.028 *	-0.018	-0.018	-0.017	-0.017
	(0.016)	(0.016)	(0.016)	(0.016)	(0.019)	(0.019)	(0.019)	(0.019)
Percent of Newly Recruited Workers	1.187E-04	8.54E-05	1.113E-04	7.94E-05	8.37E-05	3.74E-05	1.079E-04	7.79E-05
	(2.36E-04)	(2.365E-04)	(2.199E-04)	(2.207E-04)	(2.489E-04)	(2.501E-04)	(2.719E-04)	(2.719E-04)
Percent of Fixed Term Contract Workers	3.962E-04	4.335E-04	4.376E-04	4.695E-04	-3.73E-06	3.3E-05	-1.61E-06	2.23E-05
	(3.083E-04)	(3.174E-04)	(3.035E-04)	(3.132E-04)	(3.282E-04)	(3.368E-04)	(3.302E-04)	(3.311E-04)
Support for Healthcare Expenses Provided			0.011	0.010	0.011	0.011		
			(0.008)	(0.008)	(0.009)	(0.009)		
Support for Cultural, Sports, and Recreation Expenses Provided			0.012	0.012	0.009	0.009		
			(0.008)	(0.008)	(0.009)	(0.009)		
Work Leisure Provided			0.007	0.009	0.002	0.004		
			(0.008)	(0.008)	(0.009)	(0.009)		
Support for Commuting Expenses Provided			0.022 **	0.021 **	0.019 *	0.018		
			(0.009)	(0.009)	(0.010)	(0.010)		
Total Female Percent of Employees			4.989E-04	4.487E-04	0.001	0.001		
			(0.001)	(0.001)	(0.001)	(0.001)		
Company Fixed Effects Are Included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	934	934	934	934	670	670	676	676
p value	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.128	0.136	0.166	0.174	0.187	0.203	0.160	0.171

Note: *** means significance at the .01 level, ** means significance at the .05 level, and * means significance at the .10 level

Table 4. Summary Statistics Using the KWDI Data

Variable	Mean	Std Dev	Median	Min	Max	Obs
ROA (equal to Operating Profit/Total Assets and winsorized at the 1 and 99 percentiles)	0.067	0.090	0.053	-0.242	0.404	370
Operating Margin (equal to ((Operating Profit/Total Sales) * 100) and (winsorized at the 1 and 99 percentiles)	6.487	9.885	4.870	-36.090	42.330	370
Female Core Employee Ratio	0.145	0.185	0.053	0.000	1.000	370
Family Nursing Holiday Implemented	0.151	0.359	0.000	0.000	1.000	370
Female Ratio of Sawon New Recruits	0.371	0.232	0.357	0.000	1.000	370
Female Ratio of Bujangs	0.060	0.144	0.000	0.000	1.000	370
R&D Intensity	0.010	0.026	2.06E-05	0.000	0.266	370
Log(Assets)	18.555	1.946	18.095	15.421	25.998	370
Leverage	0.542	0.244	0.545	0.063	1.219	370
Export Intensity	0.034	0.140	0.000	0.000	0.960	370

Table 5. Using the KWDI Data: Foreign-Owned Firms Are More Likely To Hire Women as Senior Managers

The following table shows the results of cross-sectional regressions in which the female ratio of bujangs is the dependent variable. The t-statistics appear below the coefficients in brackets.

	DV: Female Ratio of Bujangs in Fiscal Year 2006		DV: Female Ratio of Bujangs in Fiscal Year 2007	
Independent Variable:	Model 1		Model 2	
Foreign-Owned Company	0.108		0.132	
	[1.93]		[2.37]	
in both models controlling for R&D Intensity, log(Assets), Leverage, Export Intensity				

Note: The t-statistics appear below the coefficients in brackets.

Table 6. Explaining Profitability Using the KWDI Data

The following table shows the results of fixed effects regressions in which ROA is the main dependent variable, and also where Operating Margin is the alternative dependent variable. Robust standard errors corrected for clustering at the firm appear below the coefficients in brackets.

	DV: ROA (equal to Operating Profit/Total Assets) and winsorized at the 1 and 99 percentiles							Alternative DV: Operating Margin (defined as ((Operating Profit/Total Sales)*100) and winsorized at the 1 and 99 percentiles	
Independent Variable:	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Female Ratio of Bujangs			0.158 ***	0.157 ***	0.187 ***	0.156 ***	0.184 ***	10.506 **	12.139 **
			(0.048)	(0.050)	(0.056)	(0.051)	(0.058)	(4.425)	(5.764)
Female Core Employee Ratio						0.022	0.014	4.534 **	5.024 **
						(0.028)	(0.032)	(2.076)	(2.482)
Family Nursing Holiday Implemented						-0.018 *	-0.022 **	-1.768	-2.031
						(0.010)	(0.010)	(1.607)	(1.807)
Female Ratio of Sawon New Recruits		0.035 **		0.034 *	0.037 *	0.035 *	0.039 *	2.847	3.009
		(0.018)		(0.018)	(0.020)	(0.018)	(0.021)	(2.022)	(2.307)
Foreign-Owned Company * Female Core Employee Ratio							0.037		-2.521
							(0.038)		(2.891)
Foreign-Owned Company * Family Nursing Holiday Implemented							0.043 ***		2.472
							(0.017)		(1.798)
Foreign-Owned Company * Female Ratio of Sawon New Recruits					-0.029		-0.039		-0.647
					(0.045)		(0.039)		(3.730)
Foreign-Owned Company * Female Ratio of Bujangs					-0.163 **		-0.160 **		-10.359
					(0.082)		(0.087)		(7.084)
R&D Intensity	-0.286	-0.312	-0.249	-0.275	-0.270	-0.251	-0.226	-33.434	-33.804
	(0.493)	(0.476)	(0.487)	(0.470)	(0.470)	(0.457)	(0.453)	(29.284)	(29.425)
Log(Assets)	0.027	0.022	0.021	0.016	0.013	0.014	0.010	2.702	2.509
	(0.024)	(0.024)	(0.023)	(0.022)	(0.023)	(0.023)	(0.024)	(2.732)	(2.815)
Leverage	-0.176 ***	-0.177 ***	-0.167 **	-0.169 ***	-0.163 **	-0.174 ***	-0.172 ***	-14.497 **	-14.034 **
	(0.067)	(0.066)	(0.065)	(0.064)	(0.065)	(0.065)	(0.066)	(6.786)	(6.977)
Export Intensity	0.009	0.004	0.010	0.005	0.008	0.005	0.010	1.359	1.364
	(0.043)	(0.041)	(0.043)	(0.041)	(0.042)	(0.041)	(0.042)	(2.882)	(2.846)
Survey Year is 2007	0.008	0.008	0.007	0.007	0.006	0.003	0.003	0.519	0.476
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.006)	(0.692)	(0.707)
Company Fixed Effects Are Included	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs	370	370	370	370	370	370	370	370	370
p value	0.106	0.031	0.001	0.001	0.001	0.000	0.000	0.013	0.023
R-squared	0.076	0.093	0.127	0.142	0.152	0.155	0.173	0.110	0.115

Note: *** means significance at the .01 level, ** means significance at the .05 level, and * means significance at the .10 level

Table 7. Using KWDI Data: Foreign-Owned Firms May Benefit As Much Or More From These Gender Policies and Gender Hiring

The following table shows the results of summing the effect of the gender-related variables in Model 6 of Table 6 multiplied by the foreign-owned and non-foreign-owned subsamples at their means.

	Net Effect on ROA
Foreign-Owned Company	0.040 positive ROA points (equal to 4% nominal ROA as expressed in percentage terms)
Non-Foreign-Owned Companies	0.021 positive ROA points (equal to 2.1% nominal ROA as expressed in percentage terms)

Table 8. Home-Market Managerial Demographics of Multinationals in the Combined KLI/KWDI Samples

The following table show the home-market demographic characteristics of multinationals in the combined KLI/KWDI samples.

European Only

Of total number with data for year 2005	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with other non-previously listed female executive	Number of companies with no female execs of any type	Number with no data available
35	0	0	0	0	0	35	2	1	12	20	1

Of total number with data for year 2007	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with other non-previously listed female executive	Number of companies with no female execs of any type	Number with no data available
53	1	0	0	1	0	52	5	6	10	33	0

American

Of total number with data for year 2005	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with at least one non-previously-listed female executive	Number of companies with no female executives of any type	Number with no data available	Number with not a single woman among their CEO/Chair/President/ COO/CFO/GeneralCounsel/ HeadOfHR
48	2	0	1	2	0	44	4	4	31	11	2	36

Of total number with data for year 2007	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with at least one non-previously-listed female executive	Number of companies with no female executives of any type	Number with no data available	Number with not a single woman among their CEO/Chair/President/ COO/CFO/GeneralCounsel/ HeadOfHR
55	1	1	0	6	0	47	7	6	28	17	1	38

Table 8 continued

Japanese

Of total number with data for year 2005	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with other non-previously listed female executive	Number of companies with no female execs of any type	Number with no data available	Average Female Managerial Percentage from Shikihou
35	0	0	0	0	0	35	0	0	1	34	12	2.26%

Of total number with data for year 2007	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with other non-previously listed female executive	Number of companies with no female execs of any type	Number with no data available	Average Female Managerial Percentage from Shikihou
37	0	0	0	0	0	37	0	0	1	36	7	3.8% (2.40% aside from one outlier that had 29.0%)

Non-European/Non-U.S./Non-Japanese

Of total number with data for year 2005	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with other non-previously listed female executive	Number of companies with no female execs of any type	Number with no data available
10	0	0	0	0	0	10	0	0	0	10	6

Of total number with data for year 2007	Number with female CEO	Number with female chairman	Number with female president	Number with female CFO	Number with female COO	Number with no female CEO/Chairman/ President/COO/ CFO	Number with female head of HR	Number with female general counsel/legal head	Number with other non-previously listed female executive	Number of companies with no female execs of any type	Number with no data available
9	0	0	0	0	0	9	0	0	2	7	5

Sources: company websites, company annual reports, Capital IQ, Thomson One Banker, LexisNexis, Execucomp (for American companies), and Shikihou (for Japanese companies).

Chapter III.

Do Institutions Matter in Knowledge Creation?
Quantifying the Impact of Institutional Affiliation on R&D Professionals

1. Introduction

Research has shown that foreign-educated knowledge elites are critical to the development of their home countries' economies (Kidd, 1967; Freeman, 2006), but little attention has been paid to the types of institutions they return to, or to how institutional incentives determine the nature and quality of their knowledge creation. Even "brain-drain" research takes it for granted that foreign-educated elites are beneficial for development (Carrington & Detragiache, 1998; Lowell, Findlay & Stewart, 2004) without critical and detailed examination of *how* they create knowledge upon their return to their home countries or abroad. Thus most work in this research stream limits itself to specifying the factors that pull elite students back home or push them away of their national boundaries, or to exploring how to rectify the income disparity caused by brain drain (Bhagwati & Dellafar, 1973; Portes, 1976; Glaser and Habers, 1978; Rauch, 1991; Hatton & Williamson, 2002; Rosenzweig, 2010).[29]

This lack of attention to the role of institutions is partly attributable to the difficulty of compiling reliable data on the labor-market choices and knowledge creation over time of a large sample of elite foreign-educated knowledge workers[30]. This study presents a novel empirical design to capture such data and their causal linkages. By combining multiple databases in an unprecedented fashion, we analyze the scientific output of Korean electrical-engineering PhDs in light of their institutional affiliations.

This paper aims to make the following contributions. First, via a new method of data compilation, we have been able to test the impact of institutional employers on intellectual elites at the micro level.

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[29] For the most extensive literature review on the history of the term *brain drain* and on policy debates about this phenomenon, see Gaillard & Gaillard (1998). For a more recent overview on brain drain, see Freeman (2006).

[30] Specifically, here the institutional affiliations are defined as PhDs' employer type (academia, corporate R&D and public research institutes) and nationality (US and Korea).

We first obtained a comprehensive list of all Koreans who hold U.S. doctoral degrees in electrical engineering. We then linked this list to other databases that identify their publishing and patenting activities and their institutional affiliations. Because the PhDs in our sample are quite homogeneous in their formal training and career expectations, variation in their R&D activities could function as a reliable proxy for the impact of their workplaces. Second, we use publications in conference proceedings in addition to the now standard measures of refereed publications and patent as measures of research output. In fast-moving fields like electrical engineering where conferences are significant and respected channel of knowledge dissemination, individual's conference presentations function as a reliable proxy for knowledge generation.

The paper is organized as follows. Section 2 introduces the research context, which is the electronics industry in Korea. Section 3 then summarizes the multiple databases we used and how they were compiled. Section 4 reports the empirical results, followed by a discussion in Section 5 and the conclusion in Section 6.

2. The Research Context: The Korean Electronics Industry and Its Institutions

In order to explore how institutions matter in knowledge creation, we examined how knowledge professionals' knowledge-creation activities change depending on their workplaces. We chose to study electrical engineers in the electronics industry for several reasons. First, despite its importance, the electronics industry is seriously understudied. The most influential research stream that examines the role of institutions in knowledge production typically focuses on biotechnology and the pharmaceutical industry. (For notable exceptions, see Amsden & Mourshed, 1997.) Since Boyer and Cohen's collaboration on gene cloning in 1973 gave birth to the biotech industry, which has reached $84.6 billion in annual sales, the commercial impact of knowledge creation has attracted much attention in this field. Meanwhile other domains of knowledge and their commercial manifestations have been largely neglected, including electrical engineering and electronics. In light of the direct commercial applicability of knowledge developed in academia, and the extensive history of university–industry collaboration in this

field, the lack of research is indeed surprising (Kenney & Goe, 2004). Electronics is also an industry that permits leapfrogging by latecomer countries (Gerschenkron, 1962). Compared to industries like biotech and machinery, the electronics industry offers lower barriers to entry in certain applications and types of production (Steinmueller, 2001). In this industry, technology is readily embedded in components and systems, and can therefore be transferred across borders with relative ease, enabling incremental learning (Amsden & Hikino, 1994; Kim, 1997).

The recent history of the Korean electronics industry exemplifies the latter point. Three decades ago, Korea was a country with minimal relevant knowledge in electronics; today it boasts the first, third and seventh largest IT hardware companies in the world (Figure 3-1). The strategic development of the industry has played a key role in Korea's status as a leading emerging economy (Hobday, 1995; Matthews & Cho, 2000).[31] Moreover, Korea's electronics industry is an ideal test case for examining the impact of institutions on R&D professionals' knowledge production. In Korea, a handful of large and powerful organizations have shaped the industry to a large extent. That is, the institutional context of the electronics industry in Korea is defined by a handful of visible actors, which organizations in turn exemplify different "institutional types". This characterization is particularly relevant for the Korean case, where the dominance by large firms is favored; they are highly influential in setting the norms and the choice sets in the labor market. As a result, institutions and organizations do in fact meld, and the identity of the employers largely determines the institutional context. And not surprisingly, those organizations also were the ones that have employed large numbers of the best talents in electrical engineering to build up their knowledge base (Pyun, 2012).

Meanwhile, Korea has produced a sizable population of electrical engineers over the years. Often the most talented among them went abroad to get graduate degrees in the U.S. and upon graduation, were pulled in multiple directions by diverse organizations operating within different institutional field, each with very different incentives for knowledge creation. Through the interviews with the top U.S. school

[31] Following Hobday's definition, the electronics industry will be defined here as consisting of hardware-related businesses, such as consumer goods, semiconductor and computer and telecommunications equipment (Hobday, 2001).

PhDs in electrical engineering, a few career destinations repeatedly emerged as the typical choices: academia, corporate R&D labs - most notably Samsung and LG Electronics - and public research institutes. Although the people who end up in different organizations embedded in different institutions are highly comparable in terms of their previous training, career expectations, and research potentials, where they choose to work may lead to vastly different outcomes (Pyun, 2012). Hence, we can view academia, companies and public research institutes in both countries as the subsets that compose to a large extent the working environment for the elite engineers as they engage in knowledge creation. For the purposes of this research, we use the nationality (US or Korean) and type of organization (academia, corporate R&D, and public research institutes) as instruments for the institutional context for each individual. Moreover, if we can amass a critical mass of the homogeneous individuals, follow their R&D activities and classify them according to where they work, certain patterns may emerge which then can be defined as "institutional impact". This paper is an attempt to quantitatively examine this idea.

The most relevant discussions in the existing literature deal with the *conflicting incentives* that R&D elites are faced with in different types of organizations they work for. We draw our insights mainly from two streams of thought, namely the fields of sociology of science and technology management. The sociology of science explains how the scientific community functions and why its mode of operation results in different R&D activities in different types of institutions (Merton 1968; 1973). Scientists enter a particular scientific community via the professionalization process that characterizes PhD-level training; their research output is evaluated in the form of peer-reviewed publications.[32] The norm of open science, which promotes free dissemination of the most recent developments, contributes to value creation by advancing corporate knowledge of science. This norm is perfectly aligned with academics' self-interest, because publication is the main criterion that determines academic success. But this norm poses a dilemma for scientists in the private sector (Nelson, 1959; Arrow, 1962): the main purpose of private-sector R&D is to produce knowledge that has commercial value and to appropriate as much of that value

[32] Applying Powell and DiMaggio's conceptual tools (Powell & DiMaggio, 1991), the scientific community as a whole can be viewed as an "institution" in which isomorphism is advanced via the professionalization of its members, namely their PhD education.

as possible; thus their research agendas are necessarily constrained by their employers, and open communication of ideas is not always encouraged. Hence, private-sector scientists experience conflicting loyalties: their identity is rooted in the universal scientific community, but they are contractually bound to their employers. In other words, publication is critical to maintenance of one's standing as a researcher, and is the only portable form of meaningful credentials, but one's publication record is likely to be largely determined by one's employer. Patents work differently: generally speaking, a patent enhances the inventor's status within the employing company but has a negligible effect on one's reputation in the wider scientific community. Meanwhile, engineers at public research institutes face a distinct set of incentives: though they are relatively free from the pressures of both tenure systems and market systems, their research agendas and dissemination of their ideas are subject to governmental mandates[33].

The technology-management literature approaches this issue from the perspective of how R&D professionals produce concrete knowledge using publication and patent data. Scholars in the field typically compare knowledge-creation activities at organizational level that follow different institutional norms, with less emphasis on the individual attributes[34]. Such studies have produced mixed findings on the traditional divide between knowledge-intensive industries and academia. Gittelman and Kogut (2003), for instance, argue that differences do exist across organizational boundaries. They found a *negative* relationship between academically significant science papers and commercially high-impact innovations at biotech companies, suggesting that "good science" and "valuable knowledge" are in conflict. In a similar vein, Stern (2004) shows that scientists in the private sector would be willing to accept less compensation in exchange for more freedom to publish and to pursue their own research agendas.[35] Agrawal (2006) has documented how differently academic researchers and those working for companies

[33] According to the item 15 of the Presidential Decree 17429, "Regulation on National R&D Projects", the intellectual property rights of the knowledge produced through national R&D projects belong to either the research organization or the government (depending on how this matter was negotiated between them). Individuals cannot claim rights over such knowledge. The details of the Decree are available from http://mest.go.kr.

[34] That is, they gather and analyze data at the level of organizations (or types of organizations), and do not include variables at the level of individuals. In this approach, individuals are viewed as simply a part of an organization and are lost from the analysis.

[35] Stern compares the tradeoffs that biology PhDs make when they receive multiple job offers. The sample design allowed him to calculate that there is indeed a negative relationship between compensation and freedom to engage in science as it is traditionally defined.

behave. An absence of suitable incentives causes a large proportion of inventors in academia to choose not to disclose their knowledge despite its potential usefulness to the companies that license their research. An interesting recent work by Azoulay et al. (2011) examines how organizational culture can incentivize R&D professionals differently by comparing the productivity of the scientists in Howard Hughes Medical Institute (HHMI) and National Institute of Health (NIH).[36]

But there is also substantial evidence that research activities at the organizations in different types of organizations are converging rather than diverging, which suggests that certain institutional forces may be at work. Some argue that, especially in knowledge-intensive industries, company labs are becoming increasingly similar to those at universities either as a strategic move or because academic-style labs are most suitable for the kind of knowledge they seek to produce. Gambardella (1992) found that successful pharmaceutical companies create an open, quasi-academic atmosphere in order to recruit top talents and to better utilize the fruits of public science. Cockburn and Henderson (1998) report that pharma companies invest heavily in basic science to take advantage of rapid knowledge development in bioscience. Zucker et al. (2002) suggest that close research cooperation with prominent academic scientists—"star scientists"—boosts biotech companies' capability to innovate. Lim (2009) examined how different companies absorbed a specific semiconductor technology developed by IBM, and reported that a cost-effective way for a company to learn quickly is to fund university research and to maintain close ties with the university researchers. Similarly, Furman and MacGarvie (2007) have pointed out that research conducted at public-sector research institutes has a significant impact on firm productivity.

This paper aims to contribute to the existing body of research by applying these ideas above to how the types of employing organizations impact the elite Korean PhDs in electrical engineering in producing knowledge. Identifying their patterns of knowledge production will enable us to clarify the impact on knowledge of institutions-again, proxied by different organizational types of employers- in the

[36] They found that scientist in HHMI has a higher rate of publishing high-impact papers than their counterparts in NIH, which they attribute to the more tolerant culture in HHMI.

Korean electronics industry, which will contribute in turn to better understanding of how to incentivize those with the highest potential to create valuable knowledge.

3. Data

3.1. Identifying Korean Electrical Engineers with Elite U.S. PhDs

The first step in data analysis was to compile a comprehensive list of Koreans who had obtained U.S. doctoral degrees in electrical engineering. We utilized the ProQuest Dissertations and Theses database, which lists over 2.5 million dissertations from more than 700 U.S. universities and is the standard source for dissertation research. The term *electrical engineering* was entered in the dissertation-subject field. Because this field is filled out by PhD students themselves, we concluded that it is a more accurate indicator of dissertations' subject area than such alternatives as departmental affiliation. This decision was ratified by our the interviews with several MIT and Stanford PhDs in electronic engineering (see Pyun 2012 for the description of the interview pool), who said that departmental boundaries can be ambiguous, subject to change, and variable from one school to another.

We then sought to identify Koreans among the electrical-engineering PhDs. This was possible thanks to a unique characteristic of Korean surnames: approximately 99 percent of the Korean population bears one or another of the 100 most common surnames. Thus, searching all possible Romanized versions those names will identify nearly all individuals of Korean origin. We searched for a total of 157 surnames (and their multiple Romanized equivalents).[37] From this pool, we had to filter out Korean-Americans, since our target population is elite engineers raised and educated primarily in Korea. Following Kahn and MacGarvie (2008), we used the country where an individual received his or her

[37] For the Romanization of Korean names, we used the appendix of "Open Forum on Romanization of Korean Surnames" (2001) as a reference. This document, co-published by the Ministry of Culture and Tourism and thre National Institute of the Korean Language, offers a comprehensive list of Romanized Korean surnames drawn from passports issued in 1999.

undergraduate degree as a proxy for country of origin.[38] This information was available when biographical information was included in a thesis; for the majority of dissertations that lacked such information, we used first names as a proxy for nationality. For example, an individual named Gil-dong Hong was designated Korean, but those with names like John Hong and John Gil-dong Hong were dropped from the sample.

A total of 3363 individuals remained in the final sample after applying these filters and excluding 61 PhDs whose doctorates were from Europe or Canada. The PhDs in the final sample bore 84 distinctive Korean surnames and used 175 unique ways of Romanizing their last names. The earliest doctorate in our dataset was earned in 1956, the most recent in 2010.

3.2. Dependent Variables: Conference Proceedings

In the R&D management literature, the most widespread methodology for studying innovative activities is to analyze patterns in the production of journal articles and patents. Despite their well-documented limitations as measures of innovation, journal articles and patents are widely considered the most practical and reasonably reliable proxies for scientific output.

We also employed papers published in conference proceedings as a dependent variable, an approach we believe to be a unique contribution of this paper. It has long been acknowledged that conference proceedings point to a different domain of knowledge than do journals and patents, but they are rarely included in analyses of innovation in mainstream bibliometric studies.[39] Drott (1995) found that, in research fields where timeliness and applicability are of particular importance, conference proceedings are likely to be an exclusive and indispensable channel of knowledge dissemination. This observation appears to apply to the field of electrical engineering. Lisee et al. (2008) quantitatively examined the importance of conference proceedings vis-à-vis other types of publications in all 109 academic subfields, using the share of citations made to a given type of publication as a proxy for its

[38] Kahn and MacGarvie assert that the evidence from NSF's Survey of Earned Doctorates suggests this to be true. For example, data from 2003 and 2004 show that 84.9 percent of students responded that they were citizens of the country where they had earned their undergraduate degree (Kahn & MacGarvie, 2008).

[39] Some recent efforts have been made to include conference proceedings. For the field of computer science, see Mann et al (2006) and Moed & Visser (2007); for social psychology, see Iniguez et al (2008).

influence: the field of electrical engineering & electronics ranked second in the degree to which conference proceedings matter.[40] The significance of conference proceedings in this field is also reflected in their routine inclusion in the curricula vitae of electrical engineers. Our interviews with MIT and Stanford PhDs confirmed that conference proceedings play an important role in hiring and promotion decisions.

How well does each type of knowledge production serve as a proxy for knowledge-production activities? The incentives for PhDs to publish journal articles and conference papers are clear: papers and articles are accredited to their authors, and they are portable credentials that can be carried across organizational boundaries. Switching jobs is quite prevalent among doctorate holders in this field (see Section 4.1.), and an individual's research productivity is critical in this process, especially when attempting to move from industry to academia. Publishing is also a relatively low-cost activity compared to patenting, which is expensive and time-consuming. Finally, the PhDs in our sample are likely to consider publishing comparatively easy. Having received sophisticated academic training at the best U.S. institutions, they are equipped to disseminate their research in peer-reviewed English-language journals and conference proceedings.[41] At private companies, by contrast, incentives to publish are more equivocal. Those that conform to the open norms of the scientific community will encourage their members to publish, and those that do not will attempt to block publication. In this regard, companies are apt to behave differently from universities and public research institutes. This pattern of individual homogeneity and institutional heterogeneity is highly advantageous for purposes of this study, since it enables us to observe how institutions impact individuals.

Patterns of patent production are inevitably more arbitrary. Patents were originally devised to solve the appropriability problem in innovation, namely underinvestment in intellectual property if

[40] According to the authors, 13.1 percent of all academic references in electrical engineering and electronics came from conference papers.

[41] We use English-language publication as a proxy for knowledge. Non-native English speakers who possess valuable knowledge may not be able to disseminate their knowledge in the international venues due to their lack of linguistic fluency. But the individuals we are studying belong to a homogeneous sample who received their higher education in the United States. Thus differences in their propensity to publish can safely be attributed to their institutional affiliations.

knowledge becomes a public good once it is disclosed. Thus innovation should be protected from imitation by competitors. This has traditionally been viewed as the main motivation for patenting. But whether or not to patent is ultimately a strategic choice on the part of the assignee, or the party that finances the research and hence reserves the right to benefit from the innovation. This is an important point; it determines the visibility of the knowledge produced at each decision point. For example, it is conceivable for knowledge with high potential commercial impact to be produced but remain undisclosed; instead of being patented, it is protected via other mechanisms, such as lead time, secrecy or manufacturing/design requirements. It would be impossible to track activity of this kind using the analytical scheme presented here.

What assignees gain from patenting is a subject that is still hotly debated. This line of research was largely inspired by "the patent paradox," or the prevalence of patenting despite its rather limited ability to protect intellectual property. That is, although the evidence suggests that the commercial value of most patents is virtually nil,[42] the propensity to patent is increasing in most technological fields.

Scholarly attempts have been made to explain why patents are still valued. The first group of theories focuses on the alternative uses of the patents. Long (2002) argues that patents serve as credible signals of the assignees' innovative capabilities to observers unwilling to pay the information costs of assessing them precisely. Levin (1986) hypothesizes that firms find patents useful in measuring the R&D productivity of their employees. Because patents are granted by a third party, he argues, they are an objective measure that can serve as an effective internal metric for job performance. But these types of explanation fail to resolve the initial puzzle: if low-quality patents are widespread, how can patents operate as a useful signal or a reliable performance criterion?

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[42] Parchomovsky and Wagner (2005) have summarized findings on this issue: the average value of a patent is between $7,500 and $25,000, which falls short of average acquisition costs of patents. Also, most studies find that less than 5 percent of patents have any clear commercial worth; less than 1 percent are utilized in lawsuits, and slightly over 1 percent are licensed (p. 5). Hall and Ziedonis (2001) quote surveys undertaken by Yale in 1983 and Carnegie Mellon in 1994, which found that R&D managers in the semiconductor industry consider patents to be the *least* effective measure of protection (p. 102).

Scherer's (2001) lottery theory of patents emphasizes the uncertainties of patents' payoffs. It is a well-known fact that the financial rewards of patents are highly skewed; a very few are extremely lucrative and the rest pay negligible rewards. According to Scherer, the problem is that it is only apparent in hindsight which patents will produce such high payoffs. Thus companies decide to patent all their innovations, like an individual who buys multiple lottery tickets. This theory, despite its theoretical appeal, is limited in its applicability in that the commercial payoff of patents is often far from random. It is unrealistic that companies would be completely in the dark about how their patents will fare by the time a research project results in a patent filing.

The most widely accepted explanation comes from Hall and Ziedonis (2005), who highlight the defensive use of patents. They point out that U.S. semiconductor companies have assembled patent collections whose extent cannot be rationalized in purely monetary terms. This behavior can be explained by the thesis that firms view patents as bargaining chips, not merely as a protection mechanism for their innovations. In other words, companies tend to view patent stocks as insurance that enhances their bargaining power in the market. A similar perspective, "the patent portfolio theory" (Parchomovsky and Wagner, 2005), draws attention to patents' increased usefulness when they are aggregated. Patent portfolio theory maintains that the true value of patents lies less in their individual worth than in their value when they are aggregated with other related patents. By securing a sizable patent portfolio, companies can gain many strategic advantages such as broadening the scope of future R&D activities, attracting more capital, and reducing the risk of legal defeat.

Which theory best explains patenting behavior in the Korean electronics industry? Protecting their innovations is still an important motivation for Korean electronics companies. According to a recent government report (Sohn et al., 2010), Korean electronics firms consider patents the most effective protection for their innovations, preferable to secrecy, lead-time advantage, complexity in design, utility

model rights, copyrights or design rights.[43] Korean electronics manufacturers also rely on patents to defend their innovations more heavily than do their foreign competitors (see Picture 3-1, in Appendix).

The recent history of Korean electronics companies explains well how they came to recognize the defensive function of patents over time. As early as 1986, Samsung Electronics was embroiled in a highly publicized lawsuit initiated by Texas Instruments (TI) that forced Samsung to pay $85 million, an overwhelming sum for a then-fledgling company. A TI lawyer recalled:

> *We explained why we started the lawsuit against Samsung, and how much we expected them to pay for using our technology. They were totally shocked. One person from Samsung, after recovering from the initial shock, told us that asking them to pay that much money meant closing down their business altogether*[44].

International lawsuits involving Korean electronics companies have became increasingly prevalent since the 1980s. A typical example is the series of high-profile legal cases that four Japanese plasma-display-panel (PDP) companies initiated against Samsung and LG Electronics in 2003–2004 apparently to hold their rapid growth in check. Samsung and Apple are currently engaged in numerous cross-lawsuits over smartphone technology; as of November 2011 approximately thirty legal disputes between the two firms were under way in nine countries. Ji-Sung Choi, CEO and vice chairman of Samsung Electronics, estimated that its legal expenses alone would reach $200 million by 2012 (Kim, 2011). Patent trolls (otherwise known as NPEs, or 'non-practicing entities'), organizations that purchase patents to generate revenue via lawsuits, also pose a real threat to Korean electronics giants.[45] Samsung

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[43] This finding is from the Korean Innovation Survey, included in the report; the results date from 2008. The Korean Innovation Survey is an annual survey conducted by the Science and Technology Policy Institute, a governmental think tank. The institute asked respondents to rank on a five-point scale the effectiveness of the seven mechanisms mentioned above as protection for their innovations. The sample consisted of all Korean manufacturing firms that employ ten or more people; the industry was classified according to the Korean Standard Industry Code (KSIC) at the two-digit level. Quoting research findings from other countries (Cohen et al., 2000; Hall 2009), Sohn et al. note that Korean companies are unique in their regard for patents as the best protection mechanism (Sohn et al., pp. 109-110).

[44] Quoted from Chung, pp. 65-66.

[45] Patent Freedom, a nonprofit organization that tracks the activities of patent trolls, reports that *all* of the top 25 lawsuits such firms have initiated since the mid-2000s target electronics and communications companies. This information is accessible at https://www.patentfreedom.com/.

Electronics was sued 38 times by patent trolls in 2004–2008, making the company their largest prey worldwide. LG Electronics ranked sixth, with 29 lawsuits.

The usefulness of patent data as a proxy for knowledge production in Korea's electronics industry is further confirmed by the actual relationship between the two. The data on patent assignees from United States Patent and Trademark Office (USPTO) in Table 3-1 accurately reflects the current R&D capability of each company. Again, the growth of Samsung's patent stock and its correspondence with the company's underlying capabilities well illustrates this point. For example, the first major surge in Samsung's patent production took place as the company was transforming itself from imitator to innovator (Siegel and Chang, 2006). Until the early 1990s, Samsung competed on low-cost DRAM production, but by the early 2000s it had differentiated its products through aggressive investment. The company offered more than 1,200 variations of DRAM products in 2003 and had extended its leadership in flash memory by the following year.

A report on patent propensity in Korea (Sohn et al., 2010) by a government think tank also found a meaningful relationship between patents and knowledge production. The authors examined the likelihood to patent across different industries, and found that the electronics industry has patented more actively than any other industry. Given that the electronics industry has indeed been at the forefront of value creation and knowledge creation, aggressive patenting suggests that patents can be an effective measure for the protection of knowledge creation.

In sum, it is reasonable to believe that individual knowledge creation on the part of the pool of engineers we are dealing with is likely to leave visible traces. U.S.-trained Korean electrical engineers form a strong epistemological community and have been trained to communicate their knowledge production in specific ways, namely via journals, conferences and patents. Ultimately, the strongest rationale for employing these measures is that the purpose of this paper is to measure the engineers' "social impact." It is certainly plausible that elite engineers could influence knowledge production by intangible means that are secretive, internal to the organization and thus non-detectable to the general

public. However, the social impact of knowledge created in those ways will remain minimal due to its inaccessibility.

3.3. IEEE Search: Tracking Journal Articles and Conference Proceedings

We use a novel methodology to identify journal articles and conference papers produced by the Korean electrical engineers in our study population. We chose to utilize the IEEE Xplore Digital Library in preference to the Thomson Scientific Citation Index, the database most commonly used in bibliometric studies. The Institute of Electrical and Electronics Engineers (IEEE) is a professional organization for engineers primarily in the fields of electrical engineering, electronics and computer science, and some professionals in closely related areas of science like applied physics and mathematics. As such, it is the standard platform for knowledge sharing in the electrical-engineering profession. The IEEE is the largest technological association in the world; its members number around 400,000, and represent 160 countries. The IEEE publishes more than 150 journals, magazines and transactions, and its conferences draw over 100,000 professionals annually. At present the IEEE Xplore Digital Library contains approximately 3 million documents, or nearly one-third of research documents produced worldwide in electrical engineering, computer science and electronics.

The IEEE database offers several advantages. Most importantly, it allows searches for conference papers, thanks to a recent expansion of the Xplore library. Second, the IEEE database naturally limits search outcomes to our field of interest. In multidisciplinary research, determining whether a specific piece of knowledge falls into a certain academic discipline or not can be difficult for nonspecialists, and can thus introduce noise into the data. Searching by researcher name is not a solution, because individuals with doctoral degrees in electrical engineering can conceivably veer off into other fields after graduation. IEEE search prevents such errors. Third, it offers with a single platform where a group of people can be assessed in a consistent fashion despite individual variation in academic subfields, institutional types, ages and locations. Fourth, authors' workplaces at the time their papers were produced are specified in all IEEE documents; this information is highly reliable because the authors have a strong incentive to list their affiliations accurately. Finally, the IEEE enables searches using full names, not just

initials, unlike such other databases as those of the ISI Web of Science and the USPTO. Because Koreans have so few surnames, correctly identifying an individual using only initials is unfeasible.

Locating the publications of the engineers in our study population via the IEEE involved an elaborate search process. Initially, we searched using the names on their doctoral dissertations. Most PhDs in engineering start publishing while they are still in graduate school; this circumstance and our prior knowledge of individual's university affiliations and year of graduation provided reasonable certainty of searching for the right individual. It is highly likely that individuals will continue to use the names that appear on their theses throughout their academic careers. However, a small percentage use initials instead (especially if they work in industry or have many co-authors); thus we searched for all possible combinations of initials in addition to the initial full-name search. The career trajectory of an individual who is actively publishing can be reliably reconstructed using this method. The papers produced at times of career transition are particularly helpful because they offer information on switches from one organizational type to another.

Certain cultural and institutional cues facilitated this process. For example, when two or more people with identical names actively published through IEEE, the publications produced by the engineer in question could be identified by interpreting the data. From publications during graduate school, we could identify initial research networks and an expected timeline for publishing activity. A substantial number of graduate students publish with their PhD advisors until a few years after completion of their PhDs. Papers published during this transitional period were highly useful for identifying engineers' subsequent institutional affiliations. Author order was also helpful in determining whether an individual became an academic or not. It is commonplace in science and engineering to specify the name of the principal investigator (PI) in the very end, which position typically would take five or more years for one to reach after obtaining the doctoral degree.

In our analysis of publications and patents, we eliminated from the sample those PhDs who graduated in 2007 and later. We did so because the final destination of doctorate holders in this field is often unclear early in their careers; it is customary for recent graduates to take short-term research

positions in academic or industry. Especially in industry, it only later becomes clear whether that position was the beginning of a long-term career or a stepping stone to a different arena. For engineers who have not yet fulfilled their military obligations, mandatory for Korean males[46] and for those working to earn a U.S. green card, taking on a job that they expect to keep for only a few years is very common. Taking into account as well the time lag associated with the publications' peer-review process, five years of buffer time seemed necessary.

Despite its merits, this method has a couple of shortcomings. First, pinpointing the exact timing of a particular instance of knowledge production is impossible because of the inevitable time lag between a discovery (or development) and its dissemination on a public platform. This phenomenon complicates the process of interpreting author-institution data for papers written during transitional periods. For instance, if an engineer writes a paper with her graduate-school advisor but it is published after she moves on to a private company, the author affiliation that appears on the paper can contain noise. How to code it is a significant issue because the same problem arises in every case of an institutional switch. After much contemplation, we decided to attribute a given paper to the most current workplace named. We did so for two reasons. First, it is unclear how much of the knowledge produced with previous collaborators can actually be attributed to pre-switch affiliations: some publications with such authorship appear years after one the institutional switch, in which case the new institution may merit credit, perhaps for providing new insights, facilities or funding. It is also logical to associate the post-switch institution with knowledge produced earlier, because it is likely to have hired the engineer in question precisely because of that knowledge. In this sense, the new institution can be viewed as having indirectly encouraged the knowledge production.

The second shortcoming is that IEEE search over-identifies academics, who have the strongest incentive to disseminate their findings via this venue. This is not a serious drawback, however, in that the

[46] All Korean male adults must serve in the military unless they have physical defects. Typically, in order to fulfill this, a Korean man would enter the military as a private and serve for 21 months. However, the people who pursue graduate degrees in science and engineering are given an alternative to complete this duty through working as a "Professional Researcher Staff". This option exempts them from all military obligations if he works in one of the pre-assigned companies for a minimum of 36 months upon graduation. (Source: http://www.mma.go.kr).

public nature of the knowledge produced makes for the greatest impact, which is exactly what the author wants.

It is important to note that this research design should not be taken as an attempt to judge the research capabilities of individual engineers. The number of publications tracked this way is a good proxy for academic achievement on the part of those whose research falls squarely into the realm of electrical engineering, but not for those whose intellectual contributions transcend the boundaries of the field. One can be a very prolific researcher in material science, for example, without leaving yet intellectual traces in IEEE. Thus the data represent the study population's intellectual impact strictly within the field of electronics engineering.

3.4. KRI Search: Tracking Patents

Tracking patent production called for linking the list of PhDs from ProQuest to a patent database. The most straightforward method of doing so is to search patent databases by the engineers' names, but this approach proved ineffective due to the similarity of Korean names. Searching patents by name yielded too many hits except in cases of very unusual names. Two further sets of practices complicated the classification issue. First, it is not uncommon for inventors to use their initials rather than their full names when registering patents, especially when there are many co-inventors. Furthermore, patent applications are often filed by actors other than the inventors themselves, such as patent attorneys and assignees, increasing the likelihood of variation in the Romanization of Korean names.[47] Second, although we found most of the study population's institutional affiliations via IEEE search, these affiliations were not always helpful in matching individuals to patents because a patent's assignees do not necessarily match the inventor's workplace; for example, if a college professor received a patent for

[47] For example, an engineer named Kwon Oh-Kyong used at least four different Romanizations when applying for patents: Kwon Oh-Kyong, Kwon Oh Kyong, Kwon Oh Kyoung and Kwon Oh K. Furthermore, his name was misspelled as Kwon *On*-Kyong on a U.S. patent he produced at Texas Instruments (#5090118). At present, no patent database has the ability to identify all these variants as the same person. There are several possible ways of Romanizing any Korean name; thus the likelihood of mismatching patents to their respective inventors is quite high, particularly for individuals with common names.

research funded by an electronics firm, the assignee is likely to be the company and not the university. Furthermore, inventors sometimes register patents under their own names.

In order to track an individual's patent production reliably, therefore, an alternative approach was called for. The Korea Researcher Information database (KRI), compiled by the Korea Research Foundation (KRF) provides such information. The KRF, modeled on the U.S. National Science Foundation, is a governmental organization whose main function is to evaluate grant applications and allocate research funds. To aid this process it maintains the KRI, which contains demographic data and data on the professional activities of research professionals. As of November 2011, the KRI contained information on 213,718 researchers, and on the 230,000 patents, 3.64 million papers and 510,000 book titles they had produced. KRI data is highly reliable and has been utilized in other similar searches (see Park, 2007). Most Korean research professionals need KRF grants, which gives them an incentive to keep their records up-to-date. The KRF also periodically contacts each researcher on file and asks university administrators to update the database. The most recent overhaul of the data was completed in October 2011; thus the data used in this paper is highly accurate.

The foremost merit of the KRI is that the knowledge-production activities and biographical data it tracks are classified by the individuals themselves. We could thus correctly identify an individual using the institutional origin and date of his or her PhD. Each individual's page also contained a separate section for patents; not all were complete, but the application numbers and patent titles they provided could then be searched in other patent databases.[48] This is, in our view, the most reasonable way to approach the issues that plague name-based search on patent databases.

Another strength of the KRI data is that it provides a complete career history for each person on file. This information contributes significantly to our calculation of the dependent variable "knowledge production per year" by increasing our confidence in the estimation of the denominator "years spent in

[48] KIPRIS for Korean patents and USPTO for U.S. patents. The Patsnap database was also utilized for cross-checking purposes, mainly for international patents.

each institutional type." This method also eliminates the bias that arises from selecting on the dependent variable, in that periods of non-activity can now be incorporated into the analysis.

On the other hand, filtering individuals through KRI causes professors to be overrepresented in the sample because they are the main applicants for KRF grants. But in view of the fluid boundary lines between jobs in this field, this is a less serious problem than in other industries. An absolute majority of academics in electrical engineering have worked in other types of institutions before landing in academia; this pattern makes it possible to identify the impact of institutional employers on knowledge creation.

4. Results

We analyzed knowledge production by Korean graduates of the top ten U.S. doctoral programs in electrical engineering as ranked by *US News & World Report* in 2009. As described in Table 3-2, there were a total of 762 individuals in the sample who were found through ProQuest database. The PhD who graduated the earliest in the sample Dr. Paik who studied at Stanford, who finished his doctorate in 1962. The PhDs who graduated in 2007 and afterward were eliminated from the sample because the final career destinations of doctorate holders in this field are typically unclear early in their careers. It is customary for recent graduates to take short-term research positions that they have no intention of sticking with permanently, including post-docs and research positions in industry. In the latter case, it only later becomes clear whether such a position was the beginning of a long-term career in industry or a stepping stone to subsequent jobs in academia or public research institutes. For engineers who have not yet fulfilled their military obligation—mandatory for Korean males—and for those aiming at a U.S. green card, a stopgap job is very common. Taking into account as well the time lag associated with the peer-review process for publications, five years of buffer time seemed necessary. This is the pool of people that we matched with the IEEE and KRI databases to track their knowledge-production activities.

4.1. Publication Data from the IEEE Database

It was crucial to compile accurate placement data on the Korean engineers. As noted above, our main source of career information was the IEEE.[49] Supplementary methods to retrieve such data included Internet search, patent databases and the "author finder" function embedded in Thompson Science's ISI Web of Knowledge. Internet search proved quite effective for individuals who had entered academia, especially at prestigious schools, because they tend to run their lab homepages and to disclose personal career information there. It was almost impossible, however, to use this method to track those who had gone into industry; they were inaccessible unless they shared personal information on social-network services or maintained personal websites (which were rare). We used patent databases and author searches on the ISI Web of Science only as supplements because of the similarity of many Korean names: there were simply too many individuals with the same name to reliably identify a person even after winnowing the number using graduation year and field of study. These two sources did occasionally prove useful for individuals with unique names. Individuals were dropped from the sample only if their career tracks remained unidentifiable even after using all of these methods.

4.1.1. Preliminary Data Analysis: Elite Engineers' Career Choices

We found the job destinations of 586 (72.6 percent) of the Korean electrical engineers identified through the ProQuest Database. Of those 586 PhDs, the career destinations of 560 were identified via IEEE. The rest were located through other means, such as patent database, social networking websites or newspaper articles.

The absolute majority of the elite engineers either became academics or company researchers in the United States or Korea. Table 3-3 summarizes the final job destinations of the elite engineers, aggregated by institutional type. The first interesting finding is a strong inclination toward industry in this group. Although more ended up in academia (59 percent) than in industry (37 percent),[50] it is

[49] Of the 586 PhDs analyzed in this section, we found workplace information on 560 (95.6 percent) in the IEEE database.

[50] The percentage in academia is likely to be overrepresented. Tracking via the IEEE database identifies people only when they publish, and those in academia have the strongest motivation to do so.

noteworthy that corporate R&D in electronics was able to absorb top-notch talents on such a massive scale. This pattern contrasts with the low percentage at public research institutes (PRIs): among all the PhDs active on the IEEE database, merely 3 percent ended up at Korean PRIs and only 1 percent at U.S. PRIs. There are two possible explanations: that gifted engineers do not choose to work at public research institutes, or that joining such organizations tends to end their knowledge-production activities, leaving no traces on the IEEE database. Because the latter scenario is implausible given the nature of such institutes, it is likely that corporate R&D labs in the electronics industry employ top-notch engineers in large numbers while public research institutes play a negligible role as employers of that cohort.[51] Industry as a career destination for PhD engineers looms even larger when the "interim" workplaces a PhD moves through before reaching a final career destination are taken into account (see Figure 3-2). Of those who held jobs in two or more institutional types, a staggering 76 percent had worked in industry before reaching their final destination.

The boundaries between corporate research labs, academia and public research institutes also appear to be rather fluid. Of the 586 PhDs in our sample, we found that 289 (49.3 percent) had switched from one institutional type to another at least once, and that 63 (10.8 percent) had done so at least twice. As estimates of traditional job switches, these estimates are highly conservative. First, they do not include job changes within the same employer type, such as moving from Intel to IBM. Only transitions from, say, Samsung Electronics to Seoul National University are counted. The numbers are also understated because one's institutional affiliation only appears in the IEEE database when one publishes.

The different career-choice patterns of the returnees and non-returnees to Korea are striking (see Figure 3-3). Overall, twice as many people returned to Korea as remained in the United States, with 66 percent return rate. Among the returnees, three times as many entered academia as joined corporate R&D labs. The trend was quite the contrary for those who remained in the United States, among whom there were twice as many company researchers as professors. Most noteworthy of all, hardly anyone who returned to Korea entered industry before the mid-1980s, when a handful of US-educated star engineers

[51] This insight was confirmed in interviews with a subpopulation of the sample (see Pyun, 2012).

were aggressively recruited by Korean chaebol companies to lead their pet R&D projects. Since then, the number of top-flight engineering PhDs who end up at Korean companies has steadily increased. This finding demonstrates how home-country demand has attracted elite engineers back home.

Patterns of non-patent knowledge production, defined as the total number of journal articles and conference papers, support this interpretation. Figure 3-4 compares Korean PhDs' annual knowledge production at U.S. companies and at Korean companies. Knowledge production by Korean PhDs at U.S. companies began as early as the 1960s, but their counterparts at Korean companies only began to show up on the IEEE database three decades later.[52] As noted, Korean companies began to seriously build up their competence, in terms of both size and in technological capability, in the 1990s. By the 2000s, Samsung, the top destination for elite engineers, had achieved a global presence and leadership in the semiconductor business (Siegel and Chang, 2006). Correspondingly, although knowledge production by U.S.-educated PhDs at Korean companies only began in 1989, it reached 10 percent of the total non-patent knowledge production by 1998 and 50 percent eight years later. This pattern coincides with when the U.S. educated engineers began to take jobs at Korean companies. By the 1990s and more intensively in the 2000s, Korean corporate R&D in electronics became increasingly sophisticated and knowledge-intensive.

Before going into the actual analysis, we will present the hypotheses to be tested. Although there are evidences that point to multiple directions – thus making it even more worthwhile to put our ideas to quantitative testing – the null hypotheses will be set up to reflect the conventional wisdom. That is, we hypothesize that working in academia or public research institution will be associated with higher production of journal articles and conference proceedings compared to corporate R&D labs, and vice versa for patent production. Additionally, in each type of corresponding employing organization, PhDs who are working in the U.S. will be more active in both publishing and patenting.

Hypothesis 1. PhDs employed in industry publish less than their counterparts in academia or in public research institutes.

[52] The first IEEE publication by a Korean PhD working at a U.S. company appeared in 1962; 7.9 percent of total IEEE publications by Korean electrical-engineering PhDs at U.S. companies were produced before 1990. **[OK?]** In contrast, no publications emerged from Korean companies until 1989.

H1a. PhDs employed in industry publish less peer-reviewed conference proceedings than their counterparts in academia or in public research institutes.

H1b. PhDs employed in industry publish less peer-reviewed journal articles than their counterparts in academia or in public research institutes.

Hypothesis 2. PhDs employed in industry will patent more than their counterparts in academia or in public research institutes.

Hypothesis 3. When working for the same type of employing organizations, PhDs in the U.S. will be more active in all kinds of knowledge production than their counterparts in Korea.

H3a. Given that they are in the same type of employing organizations, PhDs in the U.S. will produce more peer-reviewed conference proceedings than those who are in Korea.

H3b. Given that they are in the same type of employing organizations, PhDs in the U.S. will produce more peer-reviewed journal articles than those who are in Korea.

H3c. Given that they are in the same type of employing organizations, PhDs in the U.S. will produce more patents than those who are in Korea.

4.1.2. Publication Analysis

We now turn to our first regression model, which allowed us to estimate whether the PhDs' institutional affiliations impacted their production of conference papers and journal articles. We estimated the following specification using data at the level of publications:

$$\text{Log (PRODUCTION}ij) = \alpha + \text{INSTITUTION}ij + \text{SCHOOL}i + \text{YEARPASSED}ij + \text{cl(INDIVIDUAL)}i + \varepsilon ij$$

where i is the index for individual and j is the index for the type of institution. Each entry represents one individual at a particular type of institution. Production of knowledge, PRODUCTIONij, is basically defined as "number of publications per year" by individual i while at a particular type of institution j. The denominator, or one's tenure at a certain type of institution, is calculated as (end year of knowledge production at Institution A) – (start year of knowledge production at institution A) + 1. For example, if individual i produced journal articles while working at Intel from 1999 to 2003 and at MIT

from 2005 to 2010, the denominators used for that individual's journal counts at each institution would be 5 and 6 respectively. In the cases of PhDs who had only one research output after graduation, the time span was calculated as (2011 – graduation year).

More specifically, the dependent variables were defined as follows: (1) a simple count of conference papers or journal articles produced each year that individual i worked at a certain type of institution; (2) an author fractional count[53] of conference papers or journal articles produced each year that individual i worked at a certain type of institution. Three more dependent variables were estimated for journal articles only, because the influence of articles can be calculated using the Journal Impact Factor (JIF) from the Thomson Institute for Scientific Information's Journal Citation Report. JIF, a popular measure for evaluating the influence of academic journals, calculates the frequency with which an article in a given journal has been cited in the preceding three years. No comparable measure exists for conference papers covering the range of topics encompassed by IEEE.[54] Thus three additional dependent variables utilizing the impact factor (as a proxy of importance) were calculated only for journal articles: (3) a simple count of journal articles produced each year that individual i was at a certain type of institution, weighted by JIF; (4) an author fractional count of journal articles produced each year that individual i was at a certain type of institution, weighted by JIF; (5) a dummy variable that takes a value of 1 if, while working at a certain institutional type, an individual ever produced an article/articles in a journal whose JIF is among the top 5 percent of all electronics-related journals. Since all the distributions of publication production per year were skewed, we took natural log transforms except for the dummy variable.

The key variable INSTITUTION was coded in 7 categories. The first three represented private-sector labs, academia, and public research labs in Korea; the next three represented the corresponding

[53] Following the conventional definition in bibliometric studies, author fractional count refers to the 1/(number of total authors/inventors).

[54] Measures of conference quality are calculated using paper acceptance rates or citation frequencies; in some subfields, such measures are widely used. But there is no standard measure that can be applied to *all* conference proceedings in electrical engineering, broadly defined. This observation was confirmed by consulting a number of MIT librarians who specialize in bibliographic search and information science.

institutions in the United States, and the seventh represented post-doctoral training. Although U.S. universities employ both professors and post-docs, the two groups are easily distinguished: a post-doc position typically lasts only a few years, and in most cases we had enough information to properly classify a given PhD. The controls SCHOOL and YEARPASSED represented the university that awarded a given individual's PhD and the number of years passed since graduation. To account for the correlation within each individual, a cluster effect cl(INDIVIDUAL)i was added to the model.

4.1.2.a. Conference Results

From our sample of PhDs, a total of 763 individual–institution pairs (representing 515 unique individuals) were found to be active in producing conference papers. After zero-values for conference papers were dropped, a total of 691 individual–institutional pairs remained in the sample.[55]

In the Table 3-4, both regressions were statistically significant ($p<0.0001$) and had relatively high R square values (for simple counts, R squared = 0.1131; for author fractional counts, R squared = 0.1415). The covariate SCHOOL was dropped because there were no differences among schools in either regression. As expected, elite engineers produced conference papers most actively when they worked in academia. Compared to the reference group—engineers in corporate R&D in Korea—professors in Korea and the United States respectively produced 2.07 and 2.04 more conference papers per year. Interestingly enough, the institutional impact was larger when individual contributions were taken into account. In Model 2, where an individual's total number of conference papers per year is divided by the number of co-authors, those at U.S. public research institutes and in post-doctoral positions produced more conference papers than those at Korean companies. It is noteworthy that employment at Korean companies did not exhibit significant differences from employment at U.S. companies. U.S. companies have been considered the most prestigious destination in industry, and they are known to conduct the most sophisticated R&D activities, but they seem not to differ significantly from Korean companies in terms of how they incentivize top engineers to produce conference papers.

[55] Although the sample size decreased somewhat, the spread of institutional affiliations was very similar to that of the original sample. The same thing was true of journal production.

4.1.2.b. Journal Results

For journal production, after the zero-values for the dependent variable were dropped, a total of 608 active individual–institution pairs (representing 441 unique individuals) remained in the sample.

All the regression models were statistically significant in Table 3-5 ($p<0.0001$) with substantial R square values, ranging from 0.15 to 0.18. Institutional differences are more pronounced in producing journal articles than conference papers. Unlike conference papers, post-doctoral positions are positively associated with journal publication in all four models.

The coefficients of institutional-affiliation dummies are calculated in comparison to the reference category, which is private companies in Korea. U.S. academia unfailingly has the largest magnitude on producing journal articles, and is strongly associated with the publishing them in terms of both quantity and quality ($p<0.001$). Both professors in Korea and post-docs in the United States published significantly more actively than engineers at Korean companies. Though only professors in Korea and the United States are shown to be more productive than Korean company researchers in the first two models, U.S. post-docs have a positive impact as well when we weight the dependent variable with the journal-impact factor. Since post-doctoral positions tend to be held by individuals who intend to go into academia, it is reasonable to assume that they aim to publish articles pin more prominent journals.

These overall results can be interpreted as reflecting the publish-or-perish ethos of academia, especially in the United States, and even in a highly application-oriented discipline like electrical engineering. The strong incentives for U.S. professors to publish lead them to produce 2.15 more articles per year than their counterparts at Korean companies. On average, Korean professors published 1.52 more articles, and U.S. post-docs published 1.50 more articles, than Korean private-sector researchers.

In these sets of models, unlike in the case of conference papers, some of the U.S. universities have statistically significant relationships with the dependent variables: compared to the MIT PhDs, the PhDs from Stanford, UC Berkeley, and the University of Illinois, Urbana Champaign consistently produced more articles.

In journal publication, as in publication of conference papers, U.S. and Korean companies differ little in how intensively they encourage the elite R&D professionals to publish. The one noteworthy difference, in Model 2, is that when engineers are working in Korean companies, they tend to have more co-authors when they publish compared to U.S. companies. But the difference between Korean and U.S. companies disappears again when we weight the production weight the journal article production by impact factor in Models 3 and 4.

4.2. Patent Productivity Using Data from the KRI Database

Using the methodology described in section 3.4, we identified a total of 236 individuals and 440 engineer–institution pairs for use in the following analysis. From the ProQuest search, we know each PhD's alma mater and graduation year. Because the KRI database is rich and reliable in recording personal information, we could readily identify the people in our sample in the KRI.

4. 2. 1. Patents

Patent production by the elite engineers in the current data format in our sample is best described by a categorical variable: either they produced a patent or not when emplooyed at a certain type of institution. By contrast to the analysis based on IEEE, which records knowledge production only upon publication, a considerable number of zero values appear in the patent data collected from the KRI database. However, the KRI database reveals exactly where and how long a PhD worked throughout his or her career. In order to make use of the zero values in the dependent variable, therefore, we employed a logit model.

Table 3-6 presents three sets of logistic regression estimations. Models 1–3 are identical except that the dependent variables are calculated differently. The dependent variable in Model 1 includes patents registered in any country. Model 2 includes only U.S. patents. Because the United States is the largest market for the electronics industry, and because it is costly to apply for and register a U.S. patent, such a patent signifies that a given invention possesses a certain degree of commercial signficance. Model 3 further considers that signficance by weighting U.S. patents by their subsequent forward-

citations (that is, the citations they received).[56] If a patent did not receive any citations within 5 years of its application, it is counted as zero.

All three models in the Table 3-6 are highly significant, Models 1 and 2 at the $p = 0.001$ level and Model 3 at the $p= 0.01$ level. In Model 1, which measures production of all patents, only the U.S. faculty members appear to produce significantly fewer patents ($p < 0.05$) than their counterparts at other types of institutions. That is, faculty members at U.S. universities were 2 percent less likely to produce any kind of patent than their counterparts elsewhere.[57]

Models 2 and 3 show that employment in Korean academia is negatively associated with production of patents with international applicability and/or commercial importance. Professors in Korea produced 4.5 percent fewer U.S. patents and 6.9 percent fewer high-impact patents.[58]

5. Conclusion

Overall, we find strong evidence that the institutions do matter in elite engineers' knowledge creation. This is particularly signficant when we consider how our research design allows us to attribute such diffrences fully to the institutional incentives. The PhDs from the top schools behave very differently when they are working for industry versus when they are in academia, even in a field such as electrical engineering where people move frequently across organizational borders. As expected, they consistently publish more in both journal articles and conference proceedings when they are in academia. Also, in support of hypothesis 2, working in indistry tends to result in higher patent production. These show that the organizations in electrical engineering encourage and reward the behaviors of their members in the way that fit the traditional expectations when it comes to the institutional norms of academia vs. industry. Despite the evidences that institutional norms in different types of organizations

[56] See the Appendix for an explanation of how the citation-weight of patents was determined and applied.
[57] The range of the confidence level is 0.0006–0.8238.
[58] The range of the confidence level for the odd ratio regarding U.S. patents is 0.0059–0.3422; the corresponding figure for citation-weighted U.S. patents is 0.0113–0.4215.

are converging for PhD researchers in knowledge-intensive industries, our results propose that still institutional incentives are considerably different and do matter[59].

Additionally, the way professors behave similary and differently across national borders are interesting. While there is a strong evidence of convergence in terms of publishing in U.S. and in Korea academia, they appear to behave differently when it comes to patenting. The former suggests the institutional norms of academia is becoming universal. However, the latter can be interpreted as that the institutional norms converge based on their priorities: they tend to be assimilated first on what matters most to them.

Now we turn to the discussion on the paradox posed in the beginning of this paper. Under the current empirical design, Korean companies do not lag behind U.S. companies in all kinds of knowledge production unlike how they are commonly viewed. It is indeed counter-intuitive that Korean corporate R&D is not inferior even in the production of U.S. patents compared to U.S. companies. This may appear as the international commerciabilty of the patents produced by the PhD researchers in Korean electronics firms were at par with those from U.S. corporate labs. At first glance, this seems to be contradicting espeically the disseration essay 1, where the elite engineers were found to be deeply dissatified with the type of jobs given in Korean companies.

Nevertheless, there are at least three different scenarios that can reconcile the two. First, it may be the case that although the PhDs in Korean companies are unhappy with their jobs, they are still producing good outcomes. After all, the interviewees in the Essay 1 were referring to the suppressed possibilities and their personal frustrations, which are the matters beyond their outward actions. To capture such matters accurately, the measures such as patents may not be adequate. Strictly saying, through the quantitative data, we have no knowledge on what "could" have happened. In other words, although the data may show that the visible performances appear to be decent enough in Korean corporate labs, it is silent on whether the elite engineers could have produced more that what they already did, or if

[59] This may change if we introduce time dimension more aggressively to focus on very recent years, for example, by dropping all the observations before year 2000, which we will reserve for future research.

they could have founded venture companies. This would advocate the need for both quantitative and qualitative approaches in studying the multidimensional social issues – by nature, it was difficult to detect the casual mechanisms laid out in the Essay 1 using the quantitative metholodgies.

Second, it is also highly possible that the engineers are unhappy and they are indeed not performing well, although the current results could not show this properly. In other words, the top engnineers may be producing a sufficient numebr of patents, but in fact such patents may be mediocre in their true quality. If this is true, how to precisely assess "good performance" of the PhDs in Korean firms becomes the key issue. As one of the major complaints of the PhDs in the Essay 1was that the type of projects they are given in the firm was not interesting enough, one way to measure this woud be to compare the patents produced by the elite engineers in the sample and the best patents produced by Korean companies in the same timeframe. That is, we can compare how influential the patents produced by the engineers in our sample are vis-à-vis the highest-impact patents from the Korean companies. In order to do this, we will need to re-design the empirical scheme so to evaluate the quality of the innovative activities in a more sophisticated fashion than the current method.

Lastly, we can understand the present results as the PhDs working even harder in order to quickly exit the Korean companies, since they feel discouraged there. Under this scenario, ironically, the poor working environment may incentivize the elite engineers in the way they will get favorable recommendations so that they can leave the company soon. Nevertheless, it is a suboptimal outcome as they are still deterred from creating knowledge that is the most lucrative and innovative. Whether this hypothesis is true or not can be put to the test by interviewing a larger sample of the elite PhDs who worked in Korean companies and examining their R&D activities there on a project-by-project basis.

References

Albert, M. B., D. Avery, F. Narin, and P. McAllister. 1991. Direct Validation of Citation Counts as Indicators of Industrially Important Patents. *Research Policy* 20, 251-259.

Amsden, Alice H. 1989. *Asia's Next Giant: South Korea and Late Industrialization.* New York: Oxford University Press.

Amsden, Alice H. 2001. *The Rise of "the Rest": Challenges to the West from Late-Industrializing Economies.* New York: Oxford University Press.

Amsden, Alice. 1997. South Korea: Enterprising Groups and Entrepreneurial Government. In *Big Business and the Wealth of Nations,* edited by Alfred D. Chandler, Jr., Franco Amatori & Takashi Hikino. Cambridge University Press.

Amsden, Alice H., and Takashi Hikino. 1994. Project Execution Capability, Organizational Know-how, and Conglomerate Corporate Growth in Late Industrialization. *Industrial and Corporate Change* 3 (1): 111-147.

Arrow, Kenneth J. 1962. Economic Welfare and the Allocation of Resources to Invention, in Richard. R. Nelson, ed., *The Rate and Direction of Inventive Activity: Economic and Social Factors.* Princeton: Princeton University Press.

Azoulay, Pierre, Gustavo Manso and Joshua Graff Zivin. 2011. Incentives and Creativity: Evidence from the Academic Life Sciences. *RAND Journal of Economics* 42(3): 527-554.

Bhagwati, Jagdish N., and William Dellafar. 1973. The Brain Drain and Income Taxation. *World Development*, 1.

Carrington, W. & E. Detragiache. 1998. How Big Is the Brain Drain? *IMF Working Paper, International Monetary Fund*: Washington, DC.

Cockburn, Iain M., and Rebecca M. Henderson. 1998. Absorptive Capacity, Coauthoring Behavior, and the Organization of Research in Drug Discovery. *The Journal of Industrial Economics* 46 (2): 157-182.

Cockburn, Iain M., Rebecca M. Henderson, and Scott Stern. 2000. Untangling the Origins of Competitive Advantage. *Strategic Management Journal* 21 (10/11): 1123-1145.

Darby, M. R., and Lynne G. Zucker. 2001. Change or Die: The Adoption of Biotechnology in the Japanese and US Pharmaceutical Industries. *Research Technology* 7:85-125.

Dasgupta, P., and Paul A. David. 1994. Toward a New Economics of Science. *Research Policy* 23(5): 487-521.

DiMaggio, Paul J., and Walter W. Powell. 1983. The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields. *American Sociological Review* 48(2), 147-160.

Drott, M. (1995). Reexamining the Role of Conference Papers in Scholarly Communication. *Journal of the American Society for Information Science,* 46(4), 299-305.

Freeman, Richard B. 2006. People Flows in Globalization. *Journal of Economic Perspectives* 20(2), 145-170.

Furman, Jeffrey L., and Megan J. MacGarvie. 2007. Academic Science and the Birth of Industrial Research Laboratories in the US Pharmaceutical Industry. *Journal of Economic Behavior and Organization* 63, 756-776.

Gaillard, Ann-Marie., and Jacque Gaillard. 1998. International Migration of the Highly Qualified: A Bibliographic and Conceptual Itinerary. Center for Migration Studies: Staten Island, N.Y.

Gerschenkron, Alexander. 1962. *Economic Backwardness in Historical Perspective: a Book of Essays.* Belknap Press of Harvard University Press, Cambridge.

Gittelman, M., and Bruce Kogut. 2003. Does Good Science Lead to Valuable Knowledge? Biotechnology Firms and the Evolutionary Logic of Citation Patterns. *Management Science* 49 (4): 366-382.

Glaser, William A. & Christopher G. Haber. 1978. *The Brain Drain: Emigration and Return: Finding of a UNITAR Multinational Comparative Survey of Professional Personnel of Developing Countries Who Study Abroad.* Pergamon Press: New York.

Griliches, Zvi. 1990. Patent Statistics as Economic Indicators: A Survey. *Journal of Economic Literature* 28 (4): 1661-1707.

Hall, Bronwyn H., Adam B. Jaffe, and Manuel Trajtenberg. 2001. The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools. *NBER Working Paper Series*, No. 8498.

Hatton, Timothy J. and Jeffrey G. Williamson. 2002. What Fundamentals Drive World Migration? *National Bureau of Economic Research, Inc., NBER Working Papers,* No. 9159.

Hobday, Mike. 2001. The Electronics Industries of the Asia-Pacific: Exploiting International Production Networks for Economic Development. *Asian-Pacific Economic Literature,* 15 (1), 13-29.

Iniguez-Rueda, L., Martinez-Martinez, L., Munoz-Justicia, J., Penaranda-Colera, M., Shagun-Padilla, M., & Alvardo, J. (2008). The Mapping of Spanish Social Psychology Through Its Conferences: A Bibliometric Perspective. *The Spanish Journal of Psychology*, 11(1), 137-158.

Kidd, Charles V., 1967. Migration of Health Personnel, Scientists, and Engineers from Latin America. *Pan American Health Organization Scientific Publication #142*: Washington D.C.

Kim, Linsu. 1997. *Imitation to innovation: the Dynamics of Korea's Technological Learning.* Harvard Business Review Press.

Lisee, C., Lariviere, V., and Archambault, E. (2008). Conference Proceedings as a Source of Scientific Information: A Bibliometric Analysis. *Journal of the American Society for Information Science and Technology,* 59(11), 1776-1784.

Liu, K., Li, J., Hesterly, W., and A. Cannella. 2011. Top Management Team Experiences and Innovation: A Dual Task at Technology-Based Entrepreneurial Firms. *Working Paper.*

Lowell, Lindsay B., Allan M. Findlay and Emma Stewart. 2004. Brain Drain Optimising Highly Skilled from Developing Countries. *Asylum and Migration Working Paper 3. Institute for Public Policy Research:* London.

Mann, G., Mimno, D., & Mccallum, A. 2006. Bibliometric Impact Measures Leveraging Topic Analysis. *JCDL '06: Proceedings of the Joint Conference on Digital Libraries.*

March, James P. & Johan P. Olson. 2006. Elaborating the "New Institutionalism". In *The Oxford Handbook of Political Institutions*, edited by R.A.W. Rhodes, Sarah A. Binder & Bert A. Rockman. Oxford University Press.

Mehta, A., M. Rysman and T. Simcoe. 2010. Identifying the Age Profile of Patent Citations: New Estimates of Knowledge Diffusion. *Journal of Applied Econometrics* 25(7), 1073-1222.

Merton, Robert. 1968. The Matthew Effect in Science: the Reward and Communication Systems of Science Are Considered. *Science* 199 (3810), 55-63.

Moed, H., & Visser, M. 2007. Developing Bibliometric Indicator of Research Performance in Computer Science: An Exploratory Study. *Research Report to the Council for Physical Sciences of the Netherlands Organization for Scientific Research (NWO).* CWTS Report 2007-01.

Nelson, Richard R. 1959. The Simple Economics of Basic Scientific Research. *Journal of Political Economy* 77: 297-306.

North, Douglass. 1991. *Institutions, Institutional Change and Economic Performance.* Cambridge University Press.

Park, Chan-ung. 2007. Gender in Academic Career Tracks: The Case of Korean Biochemists. *Sociological Forum* 22(4).

Paruchuri, Srikanth, Atul Nerkar and Donald C. Hambrick. 2006. Acquisition Integration and Productivity Losses in the Technical Core: Disruption of Inventors in Acquired Companies. *Organization Science* 17(5), 545-562.

Porte, Alejandro. 1976. Determinants of the Brain Drain, *International Migration Review,* 10(4), 489-508.

Powell, Walter and Paul J. DiMaggio. 1991. The New Institutionalism in Organizational Analysis. The University of Chicago Press.

Pyun, Lynn. 2012. Caught in the Downside of Large-Firm Driven Development: Elite Engineers in the Korean Electronics Industry. *MIT PhD Dissertation.*

Rauch, James E. 1991. Reconciling the Pattern of Trade with the Pattern of Migration, *The American Economic Review*, 81(4), 775-796.

Romer, Paul M. 1994. The Origins of Endogenous Growth. *The Journal of Economic Perspectives*, 8(1), 3-22.
Romer, Paul M. 1986. Increasing Returns and Long-run Growth. *Journal of Political Economy* (94). 1002 - 1037.
Rosenzweig, Mark R. 2010. Global Wage Inequality and the International Flow of Migrants. *Yale University Economic Growth Center*, Working Papers, No. 983.
Sampat, Bhaven and Arvids Ziedonis. 2005. Patent Citations and the Economic Value of Patents: A Preliminary Assessment. *Handbook of Quantitative Science and Technology Research*, Part 2, 277-298.
Schumpeter, J. 1942. *Capitalism, Socialism and Democracy*. Harper, New York.
Siegel, Jordan I., & James Jinho Chang. 2006. Samsung Electronics. *Harvard Business School Case,* 705-508.
Siegel, Jordan I., Lynn Pyun, & B-Y Cheon. 2012. Multinational Firms, Labor Market Discrimination, and the Capture of Competitive Advantage by Exploiting the Social Divide, *HBS Working Paper* 11-011.
Snow, Daniel. 2006. Capturing Benefits from Tomorrow's Technology in Today's Product: The Effect of Absorptive Capacity. *Harvard Business School Working Paper*, 07-009.
Steinmueller, Edward W. 2001. ICTs and the Possibilities for Leapfrogging by Developing Countries. *International Labour Review*, 140(2).
Stern, Scott. 2004. Do Scientists Pay to Be Scientists? *Management Science* 50(6), 835-853.
Ungson, Gerardo R., Richard M. Steers & Seung-Ho Park. 1997. *Korean Enterprise: The Quest for Globalization.* Harvard Business School Press.
Zucker, Lynne G., Michael R. Darby and Jeff S. Armstrong. 2002. Commercializing Knowledge: University Science, Knowledge Capture, and Firm Performance in Biotechnology. *Management Science* 48 (1), 138-153.

Tables and Figures

Table 3-1. Number of Patents Held by Top 10 Korean Holders of U.S. Patents, by First-Named Assignee, 2005–2010

First-Named Assignee	2005	2006	2007	2008	2009	Total
Samsung Electronics Co. Ltd.	1569	2306	2583	3325	3394	13177
LG Electronics Inc.	461	683	665	774	1044	3627
Hynix Semicondutor Inc.	353	438	400	435	584	2210
Samsung SDI Co., Ltd.	109	150	301	415	411	1386
LG. Philips LCD Co., Ltd.	314	379	411	246	1	1351
(Individually Owned Patent)	215	257	189	195	217	1073
Electronics and Telecommunications Research Institute (ETRI)	112	171	205	254	304	1046
LG Display Co., Ltd.	0	0	0	268	590	858
Samsung Electro-Mechanics Co. Ltd.	81	126	148	170	215	740
Dongbu Electronics Co. Ltd.	21	70	188	194	187	660

(Source: USPTO website)

Table 3-2. Top 10 U.S. Graduate Programs in Electrical Engineering

Ranking	University	Number of PhDs	Percentage of the Sample (%)
1	Massachusetts Institute of Technology	39	5.1
	Stanford University	88	11.5
2	University of California, Berkeley	53	7.0
4	University of Illinois, Urbana-Champaign	64	8.4
5	California Institute of Technology	10	1.3
6	University of Michigan, Ann Arbor	126	16.5
7	Georgia Institute of Technology	173	22.7
8	Cornell University	26	3.4
9	Carnegie Mellon University	13	1.7
10	University of Texas, Austin	170	22.3

(Source: U.S. News and World Report, 2009)

Table 3-3. Career Destinations of Elite Engineers Aggregated by Organizational Type

Organizational Type of the Final Career Destinations	Number of People (from top 1-5 schools)	Number of People (from top 6-10 schools)	Number of People (from top 1-10 schools)	Percentage of total (%)
Korean company	32	51	83	14.2
Korean academia	91	179	270	46.2
Korean PRI	1	16	17	2.9
U.S. company	55	66	121	20.7
U.S. academia	31	29	60	10.3
U.S. PRI	4	5	9	1.5
U.S. post-doc	3	7	10	1.7
Venture company (founder, U.S.)	6	1	7	1.2
Public Service (Korea)	1	0	1	0.2
Japanese company	2	0	2	0.3
Patent law office (U.S.)	1	1	2	0.3
Venture finance (U.S.)	1	1	2	0.3

Table 3-4. Regression Results for Institutional Impact on Production of Conference Papers

	Model 1 (DV: Simple Count) Regression Coefficient (Standard Deviation)	Model 2 (DV: Author Fractional Count) Regression Coefficient (Standard Deviation)
Institutional Affiliation		
Korean company (reference)	(omitted)	(omitted)
Korean academia	0.7286***	1.0195***
	(0.1320)	(0.1462)
Korean PRI	0.0437	0.3171
	(0.2448)	(0.2567)
U.S. company	0.0128	0.1475
	(0.1312)	(0.1499)
U.S. academia	0.7144***	1.0969***
	(0.1616)	(0.1862)
U.S. PRI	0.2547	0.7989*
	(0.28050	(0.3339)
U.S. post-doc	0.1639	0.4177*
	(0.1457)	(0.1719)
Covariates		
Years after graduation	-0.0269***	-0.0128*
	(0.0058)	(0.0063)
R-square	0.1131	0.1306
Adjusted R-square	0.1040	0.1217

Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.

Table 3-5. Regression Results for Institutional Impact on Producing Journal Articles

	Model 1 (Simple Count)	Model 2 (Author Fractional Count)	Model 3 (JIF-Weighted)	Model 4 (JIF-weighted, author fractional count)
Institutional Affiliation Dummies				
Korean company (reference)	(omitted)	(omitted)	(omitted)	(omitted)
Korean academia	0.4865***	0.8554***	0.3406*	0.6746***
	(0.1255)	(0.1516)	(0.1330)	(0.1501)
Korean PRI	0.0868	0.2138	-0.1652	0.0259
	(0.2010)	(0.2547)	(0.1842)	(0.2690)
U.S. company	0.0937	0.3282*	0.0189	0.2933
	(0.1259)	(0.1604)	(0.1420)	(0.1656)
U.S. academia	0.7684***	1.0814***	0.8210***	1.1518***
	(0.1479)	(0.1801)	(0.1710)	(0.1853)
U.S. PRI	-0.1152	0.5202	-0.0578	0.5455
	(0.2087)	(0.4045)	(0.2274)	(0.4106)
U.S. post-doc	0.4099**	0.6968***	0.4506**	0.7272***
	(0.1407)	(0.1675)	(0.1542)	(0.1716)
Covariates				
Years after graduation	-0.0243***	-0.0151*	-0.0299***	-0.0181*
	(0.0056)	(0.0063)	(0.0061)	(0.0071)
Graduating Schools				
1. MIT (reference)	(omitted)	(omitted)	(omitted)	(omitted)
2. Stanford	0.6822***	0.7656***	0.9837***	0.8658***
	(0.1729)	(0.2027)	(0.2070)	(0.2243)
3. University of California, Berkeley	0.5062*	0.6593**	0.6728**	0.7684**
	(0.2198)	(0.2301)	(0.2546)	(0.2601)
4. University of Illinois, Urbana-Champaign	0.6475**	0.6308**	0.7712**	0.6249*
	(0.1878)	(0.2313)	(0.2301)	(0.2614)
5. California Institute of Technology	0.4193	0.3528	0.7256*	0.5273
	(0.3191)	(0.2391)	(0.3223)	(0.2710)
6. University of Michigan	0.0846	0.2470	0.1731	0.2366
	(0.1815)	(0.2051)	(0.2210)	(0.2332)
7. Georgia Institute of Technology	-0.0292	0.0874	-0.0079	-0.0081
	(0.1808)	(0.2053)	(0.2122)	(0.2244)
8. Cornell	0.3138	0.4664	0.5566	0.5985
	(0.2696)	(0.3331)	(0.2804)	(0.3285)
9. Carnegie Mellon	0.5655	0.7454	0.8031	0.6463
	(0.4692)	(0.4866)	(0.5511)	(0.5471)
10. University of Texas, Austin	0.1961	0.2994	0.2932	0.3010
	(0.1858)	(0.2029)	(0.2272)	(0.2314)
R-square	0.1552	0.1488	0.1779	0.1521
Adjusted R-square	0.1323	0.1257	0.1556	0.1291

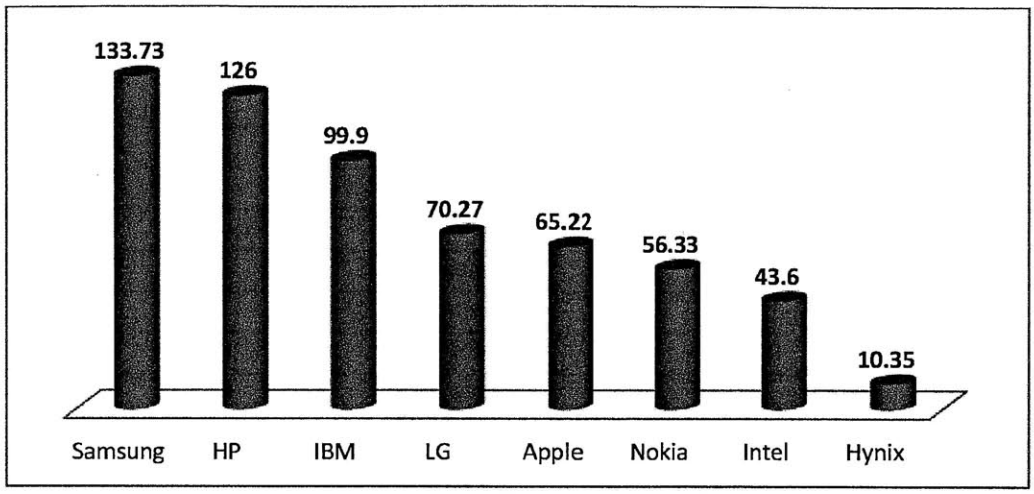
Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.

Table 3-6 . Logit Estimation of Patent Production by Institutional Types

	Model 1 (all patents)	Model 2 (U.S. patents)	Model 3 (Citation-weighted patents)
Korean company (reference)	(omitted)	(omitted)	(omitted)
Korean academia	-0.6675	-3.0985**	-2.6707**
	(0.5446)	(1.0338)	(0.9218)
Korean PRI	0.0617	-2.4513	-1.4608
	(1.2302)	(1.9506)	(1..4779)
U.S. company	-0.3922	-1.2435	-0.8100
	(0.6258)	(0.8170)	(0.7265)
U.S. academia	-3.8781*	-5.1543	-3.6967
	(1.8798)	(3.4982)	(2.8817)
U.S. PRI	-17.8818	-21.2271	-16.6400
	(5640.026)	(20916.68)	(4974.696)
U.S. post-doc	-17.6010	-21.2271	-16.5484
	(2765.965)	(20916.68)	(2519.086)
Length	0.2605***	-17.9610	0.2009**
	(0.0620)	(3199.72)	(0.0665)
Log-likelihood	-34.767782	-21.168945	-22.233952
Likelihood ratio test	$\chi2(7)$ vs. Model 1 =122.85***	$\chi2(7)$ vs. Model 2 = 45.71***	$\chi2(7)$ vs. Model 3 = 23.36**

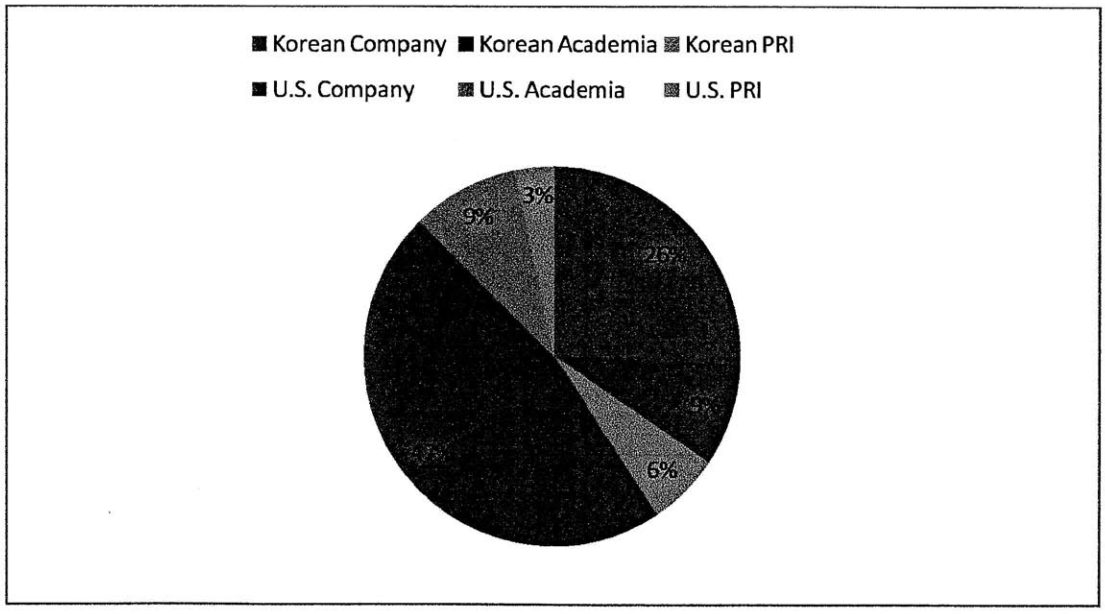
Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.

Figure 3-1. Gross Sales, Top Global IT Companies, 2010 (in $ billions)



(Source: Money Today News, retrievable from
http://www.mt.co.kr/view/mtview.php?type=1&no=2011012816170604195&outlink=1)

Figure 3-2. Interim Career Destinations[60] of Korean PhDs from Top 10 U.S. Universities



[60] As defined earlier, interim career destination refers to the workplaces where the PhDs move through before landing on their final jobs.

Figure 3-3. Final Career Destinations of Korean PhDs from Top 10 U.S. Universities

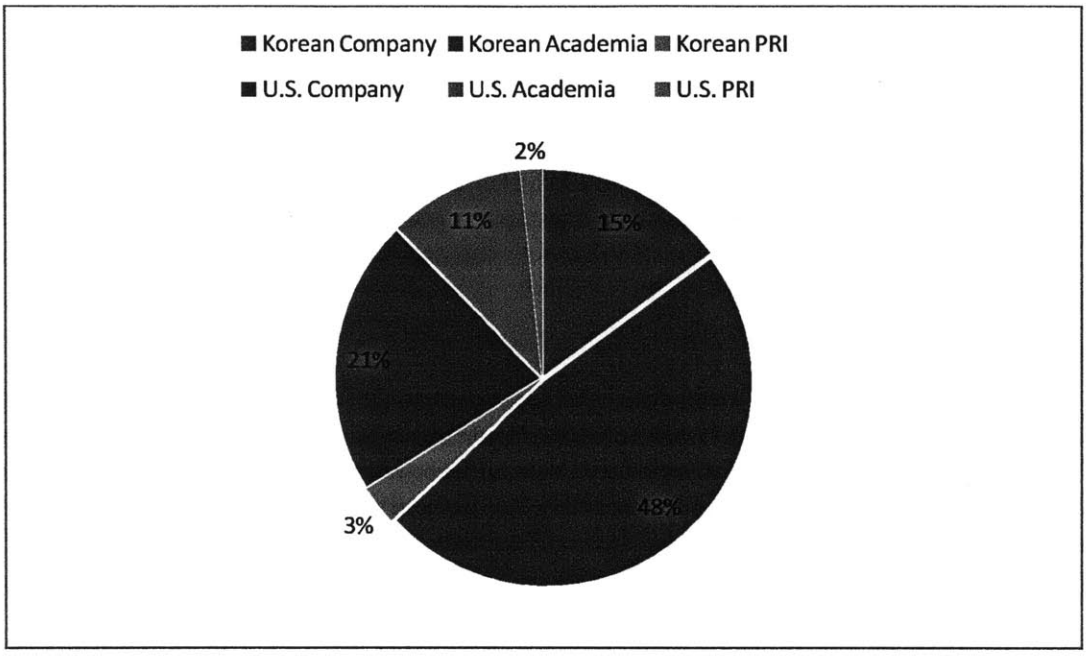
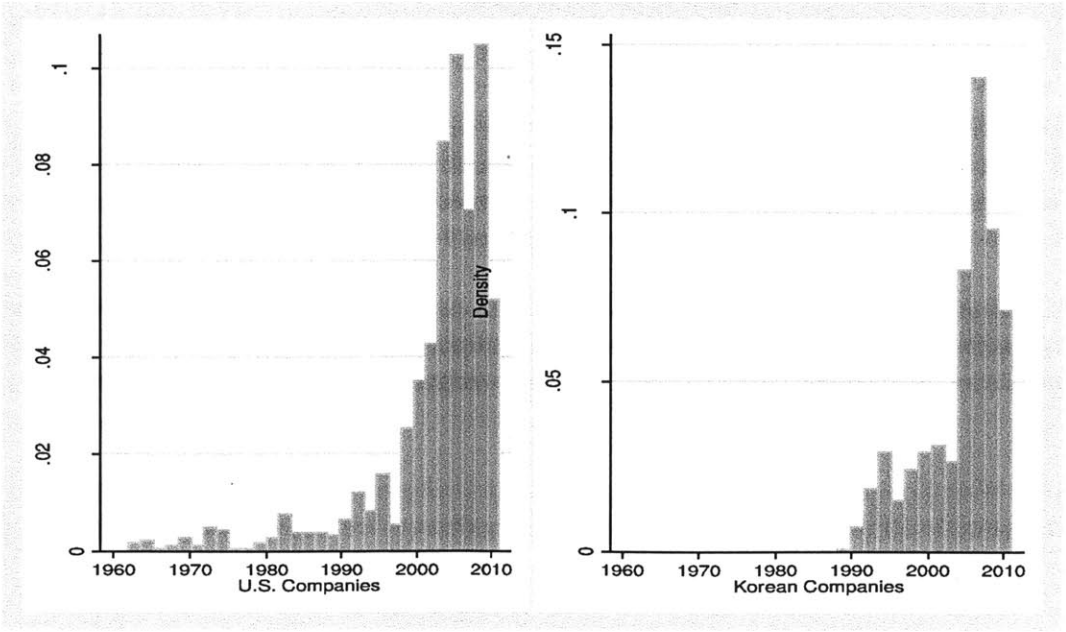


Figure 3-4. Knowledge Production by Korean Engineers at U.S. Companies and at Korean Companies



Appendix

Forward patent citations, or how many times a patent is cited by other patents, provide a useful measure on controlling the quality of patents. Simple patent counts are often criticized as a noisy measure of innovation. One helpful way to control for this heterogeneity inherent in the measure is to use citation-weighted patent counts. Forward citations of a patent indicate two things: first, they identify it as a source of the prior knowledge on which a subsequent piece of innovation is built. Second, they legally define the reach of the property rights given to the patent holder. Patent examiners play a significant role in making sure that patent citations are thorough; as technical and legal experts in a given field, they delimit the legal rights of a patent. Because patent citations are reviewed by a third party, they embody a certain level of objectivity and can be interpreted as a reflection of social returns (Griliches 1990).

Empirical attempts to confirm the value of citation-weighted patent counts as a measure of innovative outcome have found them to be a reasonable measure of patent value. Trajtenberg (1990) argued that, in the case of CAT scanners, citation-weighting patent counts makes them a far superior predictor of consumer surplus gains from R&D activities. Hall, Jaffe and Trajtenberg (1999) show that companies with highly cited patents have higher market valuations. Citation-weighted patent counts also fared well in predicting Tobin's Q (Hall et al., 2000) and were positively associated with licensing of patents (Sampat and Ziedonis, 2005). Albert et al. (1991) demonstrated the significance of citation data from a slightly different angle: by asking experts to assess a given set of patents, they found that expert ratings of technological importance were strongly associated with citation counts.

The weight we used is the number of forward-citations in the five years following application for a patent. It is necessary to specify a timeframe when counting citations, since older patents are likely to be cited more than newer ones, introducing noise into the data. Because of the truncation issue, patents applied for before 2007 are discarded for this variable. Past research shows that citations peak two years after a patent is granted or five years after application (Hall et al., 2001; Mehta, Rysmans, and Simcoe, 2010). Thus a four- or five-year window was applied to calculate the citation-weight (Snow, 2006; Paruchuri et al 2006; Liu et al 2011). Because the patents in question are all in the same industry, different patent intensities in different industries are not an issue.

Employing citation-weighted patent counts is likely to lead to markedly different regression results than simple patent counts, because citation research shows that only a few patents receive most of the forward citations. Patents that received no citations were counted as zero. Citation-weights are feasible only for U.S. patents. Other countries' patent databases do not include information on citations.