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CORPORATE DIVERSIFICATION AND PERFORMANCE: EVIDENCE FROM KOREA

A Dissertation

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirement for the

degree of

Doctor of Philosophy

By

SOON CHEUL LEE
Norman, Oklahoma
2002

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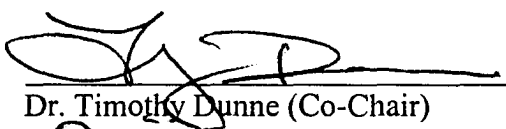
A Dissertation APPROVED FOR THE
DEPARTMENT OF ECONOMICS

By



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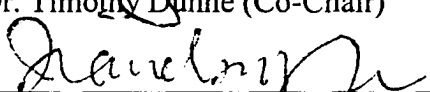

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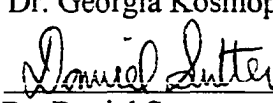

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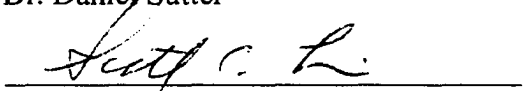

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ABSTRACT

This dissertation examines a sample of firms from the 70 largest Korean conglomerates, or *chaebols*, in order to determine the motivation behind their diversification strategies and to identify the effects of diversification on economic performance. The first essay, "Government Revenue Maximization, External Capital and Corporate Diversification," examines the argument that firms that have easy access to external capital, which is directly related to government subsidies in Korea, become over-diversified. The empirical analysis shows that firms with a high debt level are the most likely to pursue diversified expansion. Furthermore, this study shows that these firms have a tendency to decrease their diversification level when the government reduces business subsidies. The analysis conducted here is consistent with the argument that extensive and skewed subsidies lead industrial firms to accumulate considerable resources that are a springboard for excessive diversification.

The second essay, entitled, "*Chaebol* Structure and Industry Productivity Growth in Korea," focuses on the effects of corporate diversification on performance rather than any particular aim that lies behind diversification strategies. According to prevailing studies, the over-diversification of Korea's large business conglomerates was an important source of inefficiency, which resulted in an industrial structure that was particularly susceptible to the financial shocks of the 1990s. My empirical tests are consistent with this argument, as they show that industries with higher levels of *chaebol* diversification have lower levels of productivity and productivity growth. These findings are consistent with previous studies in other countries, which have found that diversification is negatively related to economic performance.

Chapter 1.

Introduction

1.1. Introduction

Theoretical and empirical studies have explored corporate diversification in the context of the evolution of market structure. These studies have focused on the motivation behind various diversification strategies and on the effect of diversification on performance because diversified companies, in general, play a significant role with respect to economic activity in many countries.[1] These studies have suggested that corporate diversification is attributable to market power (the market power hypothesis), to agency problems (the agency hypothesis), and to underutilized resources (the resource hypothesis). These studies will be reviewed in more detail in Chapter 3. Studies based on the market power and resource viewpoints propose a positive relationship between diversification and performance/value, while other studies, which support the agency viewpoint, suggest the opposite. Not surprisingly, empirical studies, which have generally focused on the effects of corporate diversification on profits and firms' value, have also resulted in mixed conclusions. These studies will also be discussed in Chapter 3 in detail.

The above studies, however, have not examined the incentives for, and effects of, corporate diversification when a government extensively intervenes in resource allocation in the financial market. It has been argued that government intervention in the capital markets in Korea has been particularly important and that it has influenced

[1] For example, the 500 largest US public companies, which increased their level of diversification during the period from 1985 to 1992, accounted for approximately 75% of the output of all public companies in 1992 (Montgomery, 1994). For the roles of diversified firms, in detail, in a number of countries, see Berry (1974), Rumelt (1982), Hubbard and Palia (1998) for USA, Caves et al (1980) for Canada, Goto (1981) for Japan, and Utton (1977) for the United Kingdom.

the industrial structure of Korea. It has been well documented that large business groups in Korea, the *chaebols*, are highly diversified and relatively large in scale for a country the size of Korea. Korean *chaebols*, such as Samsung and Hyundai, have diversified across a wide range of industries and have grown rapidly by employing diversification strategies. These Korean business *chaebols* have been found to consist of interlocking relationships across a wide variety of different-sized firms, with the larger firms integrating and coordinating the business activities of the smaller firms. The large business groups are connected with their affiliated firms through a common centralized ownership; they are also often closely connected to the government and banks.

The Korean government has been supporting the *chaebols* through a wide range of economic policies that have included initiatives such as low-interest loans, import licenses, large-scale tax benefits, and export subsidies. These policies helped the *chaebols* to grow faster than other businesses in Korea during the high-growth period. However, in spite of their fast growth, some of the largest groups went bankrupt and rocked the Korean economy before and after the 1997 Asian financial crisis. It has been argued that the *chaebols* with high debt were 'over' diversified, and that they played a very important role in causing the crisis (e.g., Krueger and Yoo, 2001; Joh, 2001). The received wisdom is that government intervention in the financial market led *chaebols* to become overly diversified, which resulted, in turn, in poor economic performance by the *chaebols*. Furthermore, mounting government intervention has created crony capitalism between the *chaebols* and the government, which has, in turn, weakened the

financial and banking system. As a result, the large financial resources that have been diverted to the *chaebols* have become a source of inefficiency for the Korean economy.

The above studies have, however, attempted to identify the motivation for the over-diversification of the *chaebols* without a well-specified theoretical and empirical model. In this dissertation, I suggest a testable theoretical model that encompasses the idea of incentives for *chaebol* diversification. This constitutes a departure from other empirical studies. Moreover, the analysis here is not limited to identifying the motivation for over-diversification on the part of the *chaebols*; it also investigates the effects of diversification on performance. Empirical studies investigating corporate diversification have measured performance in terms of invested capital, Tobin's q, and concentration ratio, rather than productivity. One significant feature of this study is that it empirically investigates the relationship between diversification and productivity.

1.2. Objectives of the Study

This study will examine the diversification behavior of *chaebols* and investigate the effects of diversification on performance. In particular, this study will address the following questions:

(1) Why do Korean conglomerates opt for a business structure that emphasizes excessive diversification as opposed to a more specialized structure?

(2) What role does the Korean government play in the diversification process of *chaebols*?

(3) What impact does *chaebol* diversification have on industry performance?

1.3. Results of the Study

The fourth chapter of this dissertation proposes a testable theoretical model by which corporate diversification may be examined. The model deals with excessive financial resources as a reason for corporate diversification, which is related, in turn, to non-market allocation of resources from the government. In other words, with limited capital available, the Korean government allocates capital to a limited number of *chaebols* in order to maximize national output. Given allocated external capital, *chaebols* then choose a number of individual divisions to minimize total costs. Under the assumption that the cost function of divisions is U-shaped, as the amount of external capital increases, the *chaebols* will become more diversified. This model is examined empirically by analyzing microeconomic data from the 70 largest business groups in Korea between 1986 and 2000. This empirical analysis finds that Korean conglomerates became more diversified if (i) the amount of external financing increased; (ii) the difference between the market capital price and business loan interest rates became larger; and/or (iii) their financial costs of external debt burden decreased. Furthermore, when reforms reducing government subsidies were introduced after the 1997 crisis, *chaebols* became less diversified. These results are in agreement with the view that *chaebols* diversification is substantially associated with their excessive use of external capital. When the external capital price for corporate funds was lower, the *chaebols* tended to become larger and diversified. In addition, the *chaebols* curbed their level of diversification after the 1997 financial crisis, when the government reduced business subsidies. These findings suggest that the government played an important role in the process of *chaebol* diversification.

The fifth chapter of this dissertation looks at how the structure of the 70 largest Korean conglomerates influenced industry performance. In order to investigate the effects of *chaebols* on industry performance, data on *chaebol* diversification are combined with data on industry productivity. This part of the study concentrates on the hypothesis that diversification of the *chaebols* has a negative impact on industry performance. To investigate this claim, I directly investigate the relationship between *chaebol* diversification and industry performance. I find that higher levels of *chaebol* diversification are associated with lower levels of industry performance.

1.4. Organization of the Study

The remainder of this dissertation is organized as follows. Chapter 2 presents a summary of the *chaebols* in the Korean economy. In Chapter 3, the previous theoretical and empirical literature pertaining to corporate diversification is briefly reviewed. Chapter 4 presents the first essay, "Government Revenue Maximization, External Capital and Corporate Diversification: Evidence from Korea." In Chapter 5, the second essay presents "*Chaebol* Structure and Industry Productivity Growth in Korea." Chapter 6 draws summary and concluding discussions.

Chapter 2.

The Background of *Chaebols* in the Korean Economy

2.1. Introduction

This chapter briefly examines the emergence, development, and the characteristics of *chaebols* in Korea based on previous studies. Many studies have discussed *chaebol* structure, behavior, and organization. Section 2.2 describes the origins and development of *chaebols*. Section 2.3 outlines the characteristics of the *chaebols*.

2.2. The Origins and Development of *Chaebols*

One of the most unique features of industrial organization in Korea is the existence of large business groups called *chaebols*.[2] Literally, a *chaebol* can be defined as 'a financial faction' or 'a financial group'. However, most Korean people use the term as 'large private enterprises' or 'the entrepreneurs' managing giant private firms.[3] For the purpose of this study, *chaebols* are defined as extremely large conglomerates, officially independent, and multi-diversified firms, which are owned and controlled by either one or two families' direct ownership.

Although major industrial programs in Korea did not begin until the early 1960s, the origins of the country's entrepreneurial elite are found in the political economy of the1950s. Very few Koreans owned or managed large corporations during the Japanese colonial period. After the independence from Japan in 1945, some Korean businessmen took over the existing Japanese firms and these firms grew into the *chaebols* of today (Fields, 1995).

---

[2] I also use large business groups or large business conglomerate groups or enterprises interchangeably.
[3] Sometimes a *chaebol* means entrepreneurial elite, big entrepreneur, or most successful capitalist.

Chaebols grew markedly in the 1960s. The tremendous rise and growth of the *chaebol*, beginning in the early 1960s, was closely linked to the expansion of Korean exports. This growth resulted from the diversification of production. In the 1950s and early 1960s, the *chaebols* concentrated on textile industries where low wage rates offered a competitive advantage; by the mid-1970s, and 1980s, the *chaebols* diversified into heavier industries including steel, machinery, defense, and chemicals -- benefiting from government subsidies. In the 1990s, the growth accelerated into electronics and high technology industries and was fueled by an explosive growth in exports, often with the help of government export promotion programs. As the Korean economy expanded, the *chaebols* also began to produce for the growing domestic market (Yoo and Lee, 1987; Kang, 2000).

The *chaebol* is a very important organization in the Korean economy. The largest 30 *chaebols* accounted for 31.1%, 40.7%, 37.3%, 39.7%, and 40.7% of total output and for 20.5%, 18.6%, 17.6%, 17.5% and 18% of employment in 1977, 1982, 1987, 1992, and 1995, respectively (Smith, 2000).

2.3. Characteristics of *Chaebols*

Large business groups are not limited to Korea but are commonly found in many countries. Korean *chaebols* are similar in some respects to Japanese *Keiretsu*. However, one important difference is they do not own and control banks because the government owned commercial banks until the early 1980s. According to the law, industrial firms were not allowed to own large shares in banks even after privatization of the banks. Moreover, the *chaebols* are more diversified, more centralized, and much more family based than *keiretsu* (Lin, Choi, & Wang, 1998; Hattori, 1989).

In the process of economic development, the *chaebols* have shown enormous growth in size, giving birth to a unique business and industrial structure. Member firms of a *chaebol* are centrally controlled in their administrative and financial activity through mutual shareholding or ownership by a limited number of families. In addition, *chaebols* strive to have a strong vertical integration and multi-diversification across industries including manufacturing, service, trade, and finance. The larger business groups are more diversified than smaller ones (Lee, 1992; Hattori, 1989; Gul & Kealey, 1999). In addition, *chaebols* have developed strong relationships with government and banking institutions.

2.4. Conclusion

I presented briefly the backgrounds of *chaebols* in the Korean Economy. This chapter depicted the Korean *chaebols* as very large and diversified firms in a wide range of industries. They are strongly related to the government and banks. In addition, the origins, development, and behavior of *chaebols* are greatly influenced by government policies.

Chapter 3.

Review of the Diversification Literature

3.1. Introduction

Many economists have studied corporate diversification in industries. This review will examine why firms diversify and present a review of the empirical evidence on the effects of corporate diversification on firm performance. There are three comprehensive perspectives on why firms diversify, as Montgomery (1994) describes: the market power view, the resource view, and the agency view. Previous studies suggest that diversification can either enhance value/performance or reduce value/performance. The market and the resource views generally predict that diversification has value-enhancing effects consistent with profit maximization. The agency view suggests a negative relationship between diversification and firm value/performance. Section 3.2 describes the theoretical views on diversification. Section 3.3 examines the empirical literature on diversification effects.

3.2. Theoretical Views on Diversification

Market Power View

Traditionally, diversification has been regarded as a survival strategy against specialized rivals, or as a way of deflecting potential threats (Shubik, 1959; Gribbin, 1976; Caves, 1981; Hill, 1983, 1985; Encaua et al., 1986; Bernheim and Whinston, 1990). From this perspective, large business firms diversify to augment their market power, the idea being that the diversification-seeking firm must obtain enough market power in an individual market to be able to exploit, extend, and defend its existing market share from existing and potential competition. Such aggregative efforts by a

group of firms would result in emergent business opportunities, lower competition, and higher industrial concentration. Most diversified firms develop market power through cross-subsidization across industries or product markets. Market power in one industry allows dominance in other industries through cross-subsidization. For example, large and diversified firms with existing market power in one industry can support predatory pricing strategies in another industry by using the profits earned in one market to subsidize below cost pricing in another market (Rhoades, 1973). Successive predation in one market also contributes to establishing a reputation, and this, in turn, reduces the costs of predation in other markets (multimarket reputation). The multimarket contract hypothesis offers another perspective on the most effective way to increase market power (Scott, 1993; Bernhein and Whinston, 1990). In this hypothesis, an active firm in several markets has a particular incentive to devise and sustain collusive agreements with major players of other industries. As a result, a new, large business group is created. This view supports the idea that diversification enhances business performance. That said, there are a number of scholars, who are opposed to theory-driven research and base their research on empirical studies. These studies have stressed that market power is not a motivating factor with respect to diversification but, rather, that it is its consequence or by-product of diversification (Montgomery, 1994; Vannoni, 2000b).

Resource View

The resource approach provides another perspective on diversification. Based on the study of Penrose (1959), this approach emphasizes the efficient use of resources. This view has been supported by Teece (1980, 1982), Nelson and Winter (1982),

Wernerfelt (1988), Caves (1982), and Lippman and Rumelt (1982). According to these scholars, firms diversify in response to the existence of excess capacity in productive factors and less-than perfectly marketable resources, when the firm reaches the minimum efficient scale.[4] In other words, a firm has an incentive to expand as long as it can operate profitably and this expansion may involve diversification (e.g., R&D and advertising investment, labor and managerial skills, and know-how). For example, when a firm is confronted with an obstacle, such as the presence of transaction costs, or contractual problems involved in the purchase or sale of intangible assets, it takes the option of internalizing resources, rather than transferring them across firms.

In addition to scale issues, diversification may also depend on the specificity or generality of the firm's resources, which, again, depend on the degree of transferability of those resources. In other words, less specific resources (e.g., a widely-recognized brand name or standard-issue milling machines) may be transferred or applied with ease to a number of different industries, and thus provide firms with a basis for diversification.[5] Thus, each diversified firm has a different level of diversification, and this level is dependent on the nature of the firm's resources.

Agency View

The agency view, the last approach to be examined here, explains diversification as the outgrowth of managers' pursuit of their own interests at the expense of their firm's owners (Jensen, 1986; Amihud and Lev, 1981; Morck et al., 1988; Shleifer and Vishny, 1991). In this model, firms are run by managers and owned by shareholders who are too dispersed to enforce value or profit maximization. Managers tend to pursue

[4] See Penrose (1959, p. 68) in detail.
[5] See Williamson (1975), Klein et al. (1978),and Grossman & Hart (1986) in detail.

diversification strategies to maximize their own objectives, such as personal power or compensation, by increasing firm size. Due to an information advantage, the managers can maximize their own objectives by utilizing cash generated by the firm to diversify, rather than paying it back directly to shareholders. As firms expand beyond the profit maximizing level, managers can increase the demand for their knowledge and specialties. This managerial behavior may strengthen their personal power and lead to an increase in personal compensation. Thus, a firm may be well diversified with respect to overall risk, but it may also face the increased and excessive managerial costs associated with the management of large and complex group firms. This perspective foresees a negative relationship between diversification and a firm's performance.

3.3. Empirical Studies of Diversification Effects

Most empirical research has focused on how corporate diversification affects firm performance. Firm performance, in terms of concentration, industry growth, industry return-to-scale, or Tobin's q (firm value), has generally been measured by accounting indices such as stock return and return on invested capital. The Herfindahl index has been used to measure diversification in most empirical studies. The empirical literature has generally found mixed results regarding the relationship between diversification and firm performance. A majority of studies have found a negative relationship between diversification and firm performance (Rhoades, 1974; Utton, 1977; Montgomery, 1985; Palepu, 1985; Beger and Ofek, 1995). Comment and Jarrell (1994) found a decrease in abnormal stock returns due to diversification. Similarly, Lang and Stulz (1994) presented evidence of a negative relationship between firm value (Tobin's q) and diversification. Berry (1974) and Caves (1981) found little definitive

empirical evidence on the relationship between diversification and firm value. Furthermore, Berry found that growing firms tend to diversify.

Some studies, though, have found a positive relationship between diversification and firm performance (e.g., Feinberg, 1985; Scott, 1982). Classifying diversified firms into nine categories, Rumelt (1982) found that the firms that diversified into related industries could increase value to a greater extent than firms which are pursuing specialization or unrelated diversification. Rapidly growing firms with significant marketing and R&D resources were the most likely to pursue diversified expansion. In the process of diversification, these firms tended to enter markets where the resource requirements were similar to their current capabilities at the firm and industry level (Lemelin, 1982; Ravenscraft and Scherer, 1987).

Recent studies show that diversification may reduce firm value/performance compared with specialized or less diversified firm counterparts (Berger and Ofek, 1995; Lang and Stulz, 1994; Servaes, 1996; Lamont and Polk, 2000). A growing literature has focused on why diversification might decrease firm value and cause poor performance. Some studies argue that the poor performance results from the inefficient distribution of resources based on cross-subsidization. This will occur when the firm invests relatively too much in the sectors of lower returns or poor performance and too little in the more profitable sectors (Berger and Ofek, 1995; Scharfstein and Stein, 1997; Rajan, Sevaes, and Zingales, 2000; Chevalier, 1999).

One study of Korean firms, Chang and Choi (1988), examined the diversification strategy and firm performance from a transaction cost approach. They found that large business groups tend to diversify to avoid higher transaction costs and

business groups with multidivisional structures are much superior in economic performance to independent firms. Similarly, examining Korean firms, Jeong and Masson (1990) found that their results strongly support the market power hypothesis. In case of Japanese firms, Goto (1981) showed that a small number of very large, highly diversified firms dominate the Japanese economy. Caves and Uekusa (1976) showed that the group-affiliated firms have lower profits than those of non-group firms in Japan. However, Itami et al. (1982) divided the diversified firms into seven strategy types, from single business to unrelated business, and found a positive relationship between related diversification and profits and growth. In a study of Taiwanese industries, Aw and Batra (1998) found that diversification tends to be solely a large firm phenomenon. Among small and medium firms, the most common form of diversification consists of diversifying into a different geographical market. The positive relation between firm size and product diversification is limited to large exporting firms in Taiwan.

3.4. Conclusion

In this chapter, I described briefly some theoretical hypotheses regarding corporate diversification. Theoretical arguments suggest that diversification is motivated by market power, efficient allocation of resources, and the agency problem. Empirical studies provide evidence that corporate diversification has two effects: performance/value enhancing or performance/value reducing effects according to the specific motivations for diversification.

Chapter 4.

Government Revenue Maximization, External Capital and Corporate Diversification: Evidence from Korea

4.1. Introduction

This chapter develops a theoretical model to generate testable implications regarding incentives for corporate diversification in cases where a firm has excessive financial resources as a result of government intervention in financial markets. This kind of situation may lead firms to overdiversify. I provide empirical evidence based on data on the 70 largest Korean business conglomerates. Over the past several decades, many theoretical and empirical studies have offered a number of reasons as to why a firm may choose to overdiversify. In their discussion of the agency view, Jensen and Meckling (1976) argue that when firms perform poorly and experience lower growth opportunities in their current activities, managers pursue their own interests at the expense of firms' shareholders, and may attempt to accumulate resources and use them to diversify. By diversifying beyond the profit maximizing level, managers can maximize their power, prestige, or compensation by increasing the firm's demand for their managerial skills or knowledge. This approach emphasizes the managers' benefits rather than firm performance or efficiency and, thus, may be used to predict a negative relationship between diversification and firm performance/value due to the increased, and sometimes excessive, managerial costs associated with the management of large and complex group firms. Teece (1980, 1982), Amihud and Lev (1981), and Wernerfelt and Montgomery (1988) have supported this perspective.

Overdiversification may also be driven by capital market imperfections. Empirical studies have looked at why industrial U.S. firms diversified during the 1960s and 1970s and then refocused their core divisions or segments in the 1980s (e.g., Lang and Stulz, 1994; Servaes, 1996). Markids (1995) has interpreted this phenomenon as a return to core activities from the overdiversification of the 1960s and 1970s, a situation that could have been due to the less-developed capital markets that existed at that time. When capital markets are less developed, diversified firms take advantage of internal and external markets. Hubbard and Palia (1998) emphasized that "diversified (U.S.) firms were perceived ex ante by the external capital markets to have an informational advantage" (p.2), and Bhide (1990) has pointed out that "the diversified (U.S.) corporation can perform the role of banker, channeling cash from units with excess cash to those requiring funds " (p.74). In other words, large diversified firms, operating across unrelated markets, can produce large amounts of cash by employing centralized resource management. Consequently, large diversified firms have an incentive to invest funds in additional risky projects, in various different, even unrelated, areas. These projects, which would not otherwise be considered as investment projects, are initiated through internal capital markets, but are operated without scrutiny from outside investors. In addition, in a situation in which capital markets are relatively less developed, the value of diversified firms may be overestimated, creating another incentive for overdiversification. Hubbard and Palia (1998) provided evidence that merging firms in the 1960s in the U.S., which was a time when well-developed external capital markets did not exist, formed their own internal capital markets. Bidding firms in mergers earned abnormal returns on acquisition announcements. As a result, under

these circumstances, diversified firms enhanced their value. However, significant improvements in capital markets have facilitated the monitoring of corporate performance, and the allocation of resources, and this has led firms to refocus on their core business activities. Markids (1995) provided evidence that widely diversified U.S. firms largely eliminated their activities in marginal and unrelated sectors during the 1980s, when capital markets became more developed. Diversified firms, therefore, are less valuable business entities when capital markets are more sophisticated, and in this situation they return to their optimal level of diversification.[6]

The perspectives on diversification mentioned above, however, have rarely investigated incentives for diversification, and the effects of corporate diversification, when a government significantly intervenes in the reallocation of resources. This has been the situation in Korea. It may be that government policies to maximize national output encourage diversification through the mechanism by which government allocates capital. The skewed and concessionary financial resources that are provided by the government for certain specific or new industries might induce firms to diversify. Suppose the government allocates capital by setting up low-interest loans to encourage firms to invest in specific new sectors, such as in the leading technology industries. In this case firms, especially the *chaebols* that have an edge with respect to market experience, size, and/or performance, can obtain substantial access to government allocated resources, at low costs, and they can utilize these resources as a basis for diversification.

[6] Markid suggested that there is an optimal level of corporate diversification, which depends on firms' managerial capacities, specific assets, and economic environment.

Current research has focused on the role of the Korean government in promoting *chaebol* diversification. It is argued that the resulting 'overdiversification' led to inefficiency and, in part, to the Asian financial crisis in Korea (e.g., Krueger & Woo, 2001; Joh, 2001; Lee, Lee, & Lee, 2002). Krueger and Woo (2001), for example, pointed out that government policies encouraged *chaebols* to diversify beyond the efficient level. Overdiversification on the part of the *chaebols* played a major part both in creating the crisis in 1997 and in intensifying its severity. Furthermore, they argued that this intervention constituted a weakness in the banking system that led to other elements of crony capitalism. In order to confirm some of these hypotheses, this chapter provides a theoretical framework for empirical research that relates incentives for corporate diversification to the influence of government policies. The idea is that a fixed resource endowment leads the government to allocate resources to a limited number of firms in order to increase output. Once the capital allocation level has been set, firms choose the number of divisions they will undertake in order to minimize their total costs. Under the assumption of a standard U-shaped cost function, as external capital allocated increases, firms tend to diversify.

The model is examined empirically by using a microeconomic dataset, composed of data from the 70 largest Korean conglomerates, or *chaebols*, for the sample period 1986-2000. The empirical analysis finds that, with respect to subsidization, Korean conglomerates become larger and more diversified as the amount of external capital (debt) they use increases (holding *chaebol* size constant). The analysis also reports that as the difference between the market capital price (defined as the average curb market interest rates) and external capital price for corporate funds

become larger, the Korean *chaebols* become more diversified. Finally, it shows that *chaebols* with lower financial costs of external debt have higher levels of diversification. In addition, our results show that when the government subsidies were reduced following the 1997 Asian financial crisis, the *chaebols* became less diversified. Thus, the results of our analysis are consistent with the view that *chaebol* diversification are related directly to the excessive supply of capital.

The rest of this chapter is organized as follows: Section 4.2 develops the theoretical model; Section 4.3 describes the data; Section 4.4 reports the empirical analysis based on the proposed theoretical model at the conglomerate level; and Section 4.5 provides a summary and concluding comments.

4.2. The Theoretical Model

In this section, I propose a two-stage model between government and industrial firms based on the case of Korea. Under limited resource endowment, the government plays a role in allocating resources to industrial firms to maximize the national output level. However, due to resource restrictions, the government may not allocate capital (i.e., resources) to all firms in industries equally. In the first stage, the government decides how much capital to allocate, which determines the output level in the economy, and then selects specific industrial firms to fulfill the target in the markets. The government charges a capital price to selected firms below the market price. In the second stage, given the output level, a firm decides the level of diversification to minimize total cost.

For simplicity, normalizing product prices, i.e., $p = 1$, the revenue is the same as output because product price is determined by the world market so the price is

exogenous in Korea, which is a small economy. The output Q of a firm is a function of capital usage by the firm. $Q = G(Tk)$ where Tk represents total capital usage by the firm. Total capital by the firm is the sum of external capital usage and internal capital usage. That is, $Tk = k + ik$, where k represents external capital usage by the firm and ik represents internal capital usage by the firm, respectively. In this model, external capital is provided by the government while internal capital refers to all other sources of capital. Assuming that k and ik are in fixed proportion, so that $ik = Ak$. Therefore, $Tk = k + ik = k + Ak = (A+1)k$. Now the production function of the firm can be written as $Q = G((A+1)k)$ and we denote $G((A+1)k)$ as $F(k)$. I assume $F(k)$ is monotonic and concave. For the given output, firms choose the number of divisions in order to minimize total costs.

4.2.1. Revenue Maximization Behavior

I consider two kind of behavior: one is the government's revenue maximization when it allocates fixed capital to a limited number of firms and the other is a firm (or *chaebol*)'s problem to choose the number of divisions to minimize its cost function given allocated external capital.

A. Government's Revenue Maximization

Let the total capital available be fixed K for the government. There are m firms selected by the government and each firm j has the capital output relation $Q_j = F(k_j)$. Consider the benchmark model in which the government maximizes total output (GDP) subjected to the resource constraint as follows: The government usually does not treat all firms equally. There are several reasons: (i) the political economy reason, i.e., the government will give more weight to firms who spend more money on lobbying or are

politically more important although economically equivalent; (ii) the information reason, the government will give more weight to firms whom they trust more; and (iii) the development strategy reason, even if the revenue is the same, the government may put more weight on some sectors, like leading technology industries. Let the weight of each firm be θ_j. The government's problem becomes:

$$(4.1) \quad \text{Max.} \sum_{j=1}^{m} \theta_j F_j(k_j)$$

$$(4.2) \quad \text{Subject to} \sum_{j=1}^{m} k_j = K$$

The Lagrangian function of the above problem is:

$$(4.3) \quad L = \sum_{j=1}^{m} \theta_j F_j(k_j) + \gamma(K - \sum_{j=1}^{m} k_j)$$

where γ represents the shadow price of the capital. Note that γ may not be equal to the capital price that the firm has to pay to the government. In the Korean case, the capital price that the government charges to selected firms is much below the market price and has even been negative for a long period of time during the industrialization period. The government artificially sets interest rates fixed at a low level for loans to industrial firms and the only restraint is that the capital price that the government charges are no lower than interest rates for savings (Joh, 2001). The first order condition of the above Lagrangian function gives:

$$(4.4a) \quad \frac{dF_j(k_j)}{dk_j} = \frac{\gamma}{\theta_j}$$

Because $F_j(k_j)$ is concave, the larger θ_j is, the more k_j will be. If $\theta_j = 1$, $\frac{dF_j(k_j)}{dk_j} = \gamma$ and k_j is efficient in the sense that it maximizes GDP; if $\theta_j < 1$, the firm cannot get enough capital to operate efficiently; if $\theta_j > 1$, the firm has more capital than the efficient level. I focus on the last case that most closely fits the case of *chaebols*. Assume that a *chaebol* has the weight $\theta_j > 1$ and let the solution to (4.4a) be $\hat{k_j}$. The assumption that $F_j(k_j)$ is concave implies that $\hat{k_j} > k^*$. The output of firm j is then determined by $\hat{Q}_j = F_j(\hat{k}_j)$.

B. The Firm's Problem

Let n be the number of sectors the firm operates. Let q_i be the output the firm produces in sector i for $i = 1,2,...,n$. The variable cost function of division i is denoted as $c(q_i)$ and identical across all divisions. Note that labor, external capital, internal capital, and other factors are used to produce q_i. The variable cost of producing is some composition of these factor values. I assume $c(q_i)$ is a standard U shape cost function (concave).

The fixed cost for each sector is denoted as f and identical across all sectors. I assume f is the investment cost and the investment of each division is assumed to be a constant I. The investment consists of internal capital and external capital. Therefore, the price of a unit of investment is some composition of internal and external capital prices. I assume that this unit price of investment is proportional to the external capital price; that is,

$$f = \delta\gamma I$$

where γ is the price of external capital and δ is the ratio of the unit price of the investment to the price of external capital. The assumption that cost functions across all the sectors are identical implies that

$$q_1 = q_2 = \cdots = q_n = q$$

Thus, the total cost function for the firm is:

$$(4.5) \quad TC = n[c(q) + \delta\gamma I]$$

The firm's total output is equal to $\hat{Q} = nq$. Note that the unit of the product in each sector is normalized such that the prices of all sectors are equal to one. The firm chooses n and q to minimize the total cost for $\hat{Q} = F(\hat{k}_i)$ which is determined by the external capital. Hence, the firm's problem is:

$$(4.6) \quad \text{Min. } TC = n[c(q) + f]$$

$$\text{subject to } \hat{Q} = nq$$

Substituting the constraint $\hat{Q} = nq$ into the total cost function, the above problem becomes

$$Min_q.\ TC = \hat{Q}\frac{[c(q) + f]}{q}$$

which is equivalent to

$$(4.7) \quad Min_q.\ AC = \frac{[c(q) + f]}{q}$$

That is the standard problem of minimizing average cost. The first order condition gives:

$$(4.8) \quad \frac{[c(q) + f]}{q} = c'(q)$$

In other words, the average cost of sector AC is minimized when the AC curve intercepts the marginal cost curve $MC = c'(q)$. Let q^* be the solution of (4.8). Then the optimal number of sector is:

$$(4.9) \quad n^* = \frac{\hat{Q}}{q^*}$$

The firm's diversification is measured by

$$(4.10) \quad D = 1 - \sum_{i=1}^{n} (\frac{q_i}{\hat{Q}})^2 = 1 - \frac{1}{n^*} = 1 - \frac{q^*}{\hat{Q}}$$

$$(4.11) \quad = 1 - \frac{q^*}{F(k)}$$

Therefore, the proposition follows:

Proposition 4.1. *As the firm's size $\hat{Q}$ or external capital increases, n^* increases and the firm becomes more diversified.*

C. The Effect of Low External Capital Price

Let's assume the government's subsidization reduces the external capital price γ, a low external capital price is obtained. Let γ^b and AC^b be the price and average cost with government subsidization, γ^a and AC^a be the price and average cost without government subsidization, and $\gamma^b < \gamma^a$. Therefore, if a reform calls to remove the government's subsidization on the firm, the firm's average cost curve after reform in each sector AC shifts up. Thus, q^* is increased and n^* is reduced, which is shown in Figure 4.1.

Proposition 4.2. *If a reform removes the subsidization to the firm, the firm becomes less diversified after the reform.*

4.2.2. Static Comparison

Let $c(q) = aq^2$. The total cost function in each sector is:

$$C(q) = aq^2 + \delta\gamma I$$

where parameter a measures the production efficiency of the firm. A firm is more efficient when a is smaller. To solve for q^*, I have:

$$MC = AC \qquad \Leftrightarrow$$

$$2aq = \frac{aq^2 + \delta\gamma I}{q} \qquad \Leftrightarrow$$

$$q^* = (\frac{\delta\gamma I}{a})^{\frac{1}{2}}$$

and

$$n^* = \frac{\hat{Q}}{q^*} = \hat{Q}(\frac{a}{\delta\gamma I})^{\frac{1}{2}} = F(\hat{k})(\frac{a}{\delta\gamma I})^{\frac{1}{2}}$$

which can be summarized as the following proposition:

Proposition 4.3. *If the firm's average investment in each division is lower, the price of external capital is lower, the firm is less efficient in production, the size of the firm is larger, or the firm's external capital usage is larger, then the firm becomes more diversified.*

Now consider that two same size firms compete in a perfect competitive market that is open to all countries, implying that the market price is equal to world market price. I use subscripts 1 and 2 to represent the variables of firms 1 and 2. Firm 1 is less efficient than firm 2, but firm 1 is subsidized by the government. Under the assumption

of perfect competition, the firms' profits are zero and thus,

$p = MC_1 = MC_2 = AC_1 = AC_2$.

Let $\gamma_1 < \gamma_2$ and $a_1 > a_2$. Hence, firm 1 has lower external capital price and is less efficient in production than firm 2. It is shown in Figure 4.2 that $q_1^* < q_2^*$, which implies that firm 1 is more diversified than firm 2.

This theoretical model sets out a reason that explains why *chaebols* generally chose a highly diversified business structure. In Korea, the government has played an important role in the *chaebol* diversification process, as it has allocated limited financial resources favorably to the *chaebols*, in a situation in which financial resources were limited. Given allocated capital, concessionary capital increases, and *chaebols* tend to diversify. The remaining sections of this chapter explore empirically this possibility.

4.3. Data

The data set relates to the 70 largest business groups, *chaebols*, operating in the Korean economy between 1986 and 2000. The datasets of the Korean Economic Research Institute (KERI), National Information & Credit Evaluation (NICE), and LG Securities (LG) are used in this analysis. The KERI dataset contains information on the 70 *chaebols* and non-*chaebol* firms since 1986, though there is limited financial information. The dataset has an advantage of identifying 70 *chaebols* and their affiliated firms. The affiliated firms of *chaebols* are identified as firms that are under the same ownership or under the control of a single business group. The missing data and information are augmented by the datasets of NICE and LG.[7] Diversification is

[7] The three state-owned business groups are excluded.

defined according to each *chaebols*' activity in more than one industry at the two-digit Korean Standard Industry Classification (SIC) level.

As seen in Table 4.1, the 70 *chaebols* that were in operation during the sample period have 1,494 affiliated firms. Firms having primary SIC codes in finance or banking (SIC 65-69) are regulated; they either have a different financial structure (e.g., no sales), or they do not report information. As these factors make comparisons difficult, these firms were excluded from this study. In addition, with this elimination, some *chaebols* have only one or two affiliated firms that tend to be marginal firms in the non-finance and banking industry that are within the same *chaebol.* When these chaebol firms are included in the sample, they seem to be quite specialized. As this factor also makes comparison difficult, these firms are not considered with respect to the analysis. After eliminating the 157 observations of financial and banking firms and these marginal firms, the number of affiliated firms of *chaebols* is 1,337 during the sample period. Without financial and banking firms, on average, each *chaebol* has 19 affiliated firms and engages in six or seven different two-digit industries for each sample year.

Even with the additional data from NICE and LG datasets, 160 *chaebol*-firms still have missing data. These observations are again deleted from the sample. In analyzing the *chaebol* diversification, 1,177 firms have complete information for the sample period. The average number of affiliated firms and engaged industries of each *chaebol* are 16.81 and 5.57 at the 2-digit SIC level, respectively.

4.4. Empirical Analysis

4.4.1. The Empirical Model

Based on the results from proposition 4.3, I formulate a simple empirical model to test whether Korean diversification patterns agree with the predictions of the model. Overall, the empirical analysis will look at how financial factors, and in particular, the use of external capital influences diversification. The specific measures used in the analysis are detailed below. However, the ultimate objective is to see whether *chaebols* that rely on a greater proportion of external capital provided by the government and have lower financing costs are more likely to be diversified. Admittedly, these are indirect tests of the hypothesis that government policy has led to increased diversification. The data I have assembled cannot be used to directly analyze the interaction between the government and individual *chaebols*. That said, however, I can examine the relationship between interest rate differentials, the cost of capital, and the use of debt and *chaebol* diversification. This should shed light on the role of external capital in the diversification process.

I consider several factors that are thought to have influenced the diversification of Korean *chaebols*. First, I look at whether *chaebol* diversification behavior is correlated with financial factors; this is associated with government financial policies for allocating capital in Korea. Krueger and Yoo (2001) argued that government financial policies encouraged crony capitalism, as exemplified by the close relationship between the *chaebols*, the government, and the banks, and further weakened the banking system in the period before the Asian financial crisis of 1997. These factors helped the *chaebols* to achieve high levels of debt, which may have led, in turn, to

diversification that was beyond their capacities. This weakness has been identified as one of the possible factors that led directly to the 1997 crisis and intensified its severity. For example, in the preceding recession, the government intervened in the financial markets in which the *chaebols* directly participated. These interventions included interest rate cuts, an increased supply of facility investment funds, and the early implementation of government projects. As a result of direct government involvement, the *chaebols* were motivated to increase capacity. However, in such a context, the incentive for banks to operate with due diligence with respect to a monitoring function is weak. In addition, there is an unwillingness to force corporate bankruptcies, as well as the existence of outright corruption. These government interventions directly distorted the distribution of resources and allowed *chaebols* to raise unprecedented amounts of capital investment in the period 1994-1996 (Haggard and Mo, 2000). As a result of government intervention in the allocation of capital, *chaebols* were able to access large amounts of external capital at a relatively low cost, which meant that *chaebols* were given the financial resources to expand and diversify. Thus, one might expect that an increase in *chaebol* debt raise the level of diversification. This would also be consistent with the argument that corporate diversification is positively correlated with the excessive usage of external capital supported by a subsidized price of that capital.

Next, I test the hypothesis that industrial firms became less diversified after the 1997 crisis, in that certain reforms put a stop to the government subsidization of industrial firms. After the Asian financial crisis in 1997, the Korean government implemented reforms that reduced subsidization to firms, forcing *chaebols* and non-

chaebol firms to cut down on those affiliated firms that were inefficient. These reforms resulted in a reduction, on the part of the *chaebols*, in their degree of diversification.

In order to investigate impacts of these factors on corporate diversification, the following regression model is estimated based on proposition 4.3:

$$(4.12)\quad D_{it} = a_i + a_1 \ln Asset_{it} + a_2\left(\frac{Debt_{it}}{Asset_{it}}\right) + a_3 ID_t + a_4 FC_{it} + a_5 Dummy_t + e_{it}$$

where a_i is the *chaebol* fixed effects for *chaebol* i and e_t is the error term in time t.

I examine two dependent variables for D, which measure *chaebol* diversification: the Herfindahl Index (Div) and the log of segment number (lnSeg). The Herfindahl Index incorporates information on the size distribution, as expressed by the square of the share of the ith product (or firm) in total sales, in *chaebol c*, as follows:

$$Div_c = 1 - \sum s_{ic}^2$$

where s is the share of the product. This index is sensitive to the number and distribution of products and is defined from zero to one.[8] The value of the index becomes zero if a *chaebol* produces one product and increases as a *chaebol* increases the number of products that it produces. Alternatively, I measure the log of the number of segments (lnSeg) a *chaebol* operates in each year at the two-digit SIC level. This index gives us a simple measure of corporate diversification. The larger the index value, the greater the level of a *chaebol*'s diversification.

The independent variables include controls for the characteristics of *chaebols*, the role of government intervention in the market, and the role of reform. With respect to the characteristics of *chaebols*, *chaebol* size is controlled for by the log of total assets

[8] This index has been used to measure diversification in most empirical studies (e.g., Schoar ,2000; Lang and Stulz, 1994).

of each *chaebol* ($\ln Asset_{it}$). Clearly, as *chaebol* size increases we would expect *chaebols* to become more diversified. Table 4.2 shows that overall *chaebol* size is strongly correlated with *chaebol* debt. In order to control for access to external capital, I use the ratio of debt to assets ($\frac{Debt_{it}}{Asset_{it}}$) for a *chaebol*. If *chaebols* are beneficiaries of government support, which includes low interest loans, *chaebols* are more likely to increase debt levels and to use external capital as a source of financing. Thus, one might expect *chaebols* with high ratios of debt to assets to be more diversified. It is also possible, however, that *chaebols* with high debt levels are in financial distress and that these *chaebols* are unlikely to diversify. Finally, systematic differences in the level of diversification due to such factors as difference in managerial efficiencies are controlled for by *chaebol* fixed effects.

In Korea, it has been argued that government policies with respect to the allocation of capital constituted the most important factor leading to the creation of large and highly diversified *chaebols*. The Korean government controls the banks and the levels of credit offered to industrial firms. To encourage economic development, the government privileged some key industries and selected firms. When these firms entered the industries selected by the government, they received assistance and were allocated significant amounts of capital at below market interest rates. The government directed both state-owned and commercial banks to fund these industrial firms. Such bank loans, or so called 'policy loans' carrying low interest rates, benefited the *chaebols*. Thus *chaebol* expansion into new industries was funded, indirectly, by the government (Lee, 1992; Chung et al., 1997). In addition, because of their close relationship with the government and the banks, it was easier for *chaebols* to borrow

capital from banks than it was for non-*chaebol* firms. As a result, this significant allocation of capital at lower interest rates provided an incentive for *chaebols* to become larger and more diversified. Thus, high levels of *chaebol* diversification are likely to be positively correlated with high debt levels and low external capital price.

In order to control for government intervention in financial markets, I use a number of financial indicators. The interest difference (ID_t) is equal to the market interest minus the interest rates from Deposit Money Bank (DMB) loans to the corporate sector. It provides an indication of how *chaebols* receive advantages by borrowing from DMBs. The larger the difference between the two variables, the greater the advantage offered to firms, particularly to *chaebols*, by their close relationship with government and banks, and hence their increased diversification. DMB interest rates are the price of external capital for corporate financial funds controlled by the government. I use the average interest rates of DMB loans to enterprises from the Bank of Korea (AAAB022). The market interest rate, as the shadow price of external capital, is proxied by the average curb market interest rates from the Bank of Korea (AAAB2). As a source of funds for the corporate sector, loans from informal markets, such as the curb market, are substantial in Korea. For example, according to the data from Field (1995, p. 106), 17.2%, 19%, and 20.2% of loans to the corporate sector were from banks, non-banks, and informal markets, respectively, during the period 1987-91.[9] This implies that loans from the informal market are one of the most substantial sources of capital for Korean firms and reflect the market price of capital in Korea.

[9] During the period 1982-86, the following percentages pertain: 22.6%, 19.2%, and 24.9% from banks, non-banks, and informal markets, respectively.

I also control for differences in financing costs at the *chaebol* level. A financial cost variable (FC_{it}), which is constructed as the interest payments of a *chaebol* divided by debt of the *chaebol*, is used to proxy for differences in financial costs across *chaebols*. As I discussed above, *chaebols* with close relationships to the government and banks generally receive low interest loans. Therefore, firms that receive greater subsidies should have low interest payments per unit of debt. In our model, lower financing costs lead to more diversification.

Finally, I use a year dummy variable to control for how *chaebols* changed their diversification behavior before and after the reforms of 1997 that reduced government subsidies. The year dummy is set equal to one between 1997 and 2000, and to zero otherwise. I expect a negative sign for the year dummy variable, because the government reduced its subsidization of firms after the financial crisis, and *chaebols*, therefore, became less diversified.[10] Table 4.3 provides summary statistics for variables in the regression analysis. All variables except interest variables are deflated by the two-digit producer price indices constructed by the Bank of Korea.

4.4.2. The Empirical Results

The results of the diversification regressions are represented in Table 4.4 and 4.5 for a sample of 70 *chaebols* in Korea, from 1986 to 2000. The base specification includes *chaebol*-fixed effects and uses an unbalanced panel, as some *chaebols* went bankrupt and disappeared after the financial crisis in 1997. Table 4.4 presents the first set of regression results with the Herfindahl Index (Div_{it}) as a measure of *chaebol* diversification. The first column of Table 4.4 reports the results of a regression that

[10] Note that a negative demand shock during the financial crisis could also lead *chaebols* to become less diversified.

includes the *chaebol* size ($\ln Asset_{it}$) and the ratio of debt to assets ($\frac{Debt_{it}}{Asset_{it}}$) as control variables. I find that *chaebol* diversification is positively related to the asset size of *chaebols*. The result indicates that large *chaebols* have high levels of diversification. This is in agreement with the argument noted previously, i.e., that large firms tend to diversify (Berry, 1974; Lechtenberg, 1991).

The debt-asset ratio is statistically significant and has a positive impact on diversification. Holding firm size constant, an increase in debt-asset ratios raises the level of diversification. This is consistent with numerous previous studies, which have argued that easy access to external capital provided an impetus to *chaebols* to expand and diversify (Joh, 2001; Krueger and Woo, 2001; Lee et al., 2002; Chung et al., 1997).

The second column includes the external capital price in order to investigate the role of the price of external capital arising from government intervention in allocating capital in the financial markets. The large and positive sign on ID indicates that the larger the difference between market interest rates and DMB's interest rates (ID), the higher the level of diversification. The results also show that diversification is negatively related to financial costs. These results agree with the hypothesis that government support of low interest loans to *chaebols* gave *chaebols* an advantage with respect to the availability of capital, as well the opportunity to become larger and more diversified.

The third column includes a year dummy to control for how *chaebols* changed their diversification behavior before, and after the Crisis, when the reforms that reduced government subsidies were implemented in 1997. I found the year dummy to be negatively associated with diversification, implying that *chaebols* decreased their

diversification level after the Crisis. This is in agreement with the argument that government reforms led *chaebols* to decrease diversification. However, one needs to be cautious in over-interpreting this result. Clearly, *chaebols* faced real negative demand shocks during this period and this might also be correlated with the reduction in *chaebol* diversification. The other results are the same as those of the second column. Finally, I report the F tests for the significance of the fixed effects in all regressions. The observed F values, which are statistically significant and large, indicate that the fixed effects matter in all specifications.

My next set of results repeats the analysis, but examines the number of segments as a dependent variable, instead of the Herfindahl diversification index. The structure of Table 4.5 is similar to that of Table 4.4. The overall results are also very similar to those presented in Table 4.4. The signs on independent variables are the same, but their magnitudes are somewhat increased and become statistically more significant. The debt-asset ratio variable, however, becomes smaller and statistically insignificant in the third column.

Alternatively, I estimate the same regression, allowing *chaebol*-random effects to control for the unobserved heterogeneity of *chaebols*. The random-effects estimator differs from the fixed-effects estimator because the random-effects model uses cross-chaebol variation to identify the parameters, while fixed-effects model uses only within-firm variation to estimate the parameters. I report the results in Table 4.6. The results of the random-effects model are very similar to those of the fixed-effect model in all regressions.

Over all, as expected from the theoretical model, the analysis finds that *chaebols* become more diversified if their usage of external capital is increased (holding *chaebol* size constant), the price of external capital is lower, and/or the financial costs decrease. In addition, the crisis of 1997 led *chaebols* to become less diversified. The findings are consistent with the hypothesis that *chaebol* diversification is related to easy access to external capital.

4.5. Summary and Conclusion

This chapter examined the relationship between diversification and financing issues, using a sample of 70 Korean conglomerates operating in Korea between 1986 and 2000. In this chapter, a testable theory was proposed for a situation in which the government allocated financial resources to a fixed number of firms to maximize the national output level. Given allocated external capital and a standard U-shaped cost function, firms choose the number of their divisions to minimize the total costs. The model shows that as the amount of external capital increases, firms will be more diversified.

Empirical analysis shows that *chaebols* with high debt to assets ratio had high levels of diversification. Larger differences between the market capital price and business loan interest rates also led to higher levels of diversification. *Chaebols* with lower levels of financial costs of external debt have higher levels of diversification. In addition, *chaebols* reduced their level of diversification after the 1997 crisis. The results indicate that firms have an incentive to diversify when they have access to cheap external capital. Overall, the results are consistent with the argument that *chaebols* are

overly diversified as a result of government support, as discussed by Krueger and Yoo (2001).

Table 4.1. Sample Information and Basic Statistics

Sample Periods: 1986~2000	
Number of Korean business groups, known as *chaebols*	70
Number of firms affiliated with the *chaebols*	1,494
Number of non-financial and banking firms within the *chaebols*	1,337
Average number of affiliated firms for each *chaebol*	19.11 (13.87)
Average number of industries in which each *chaebol* was engaged for each sample year	6.29 (3.96)
Observations in Analysis*	
Number of affiliated firms in analysis	1,177
Average number of firms affiliated with each *chaebol*	16.81 (12.47)
Average number of industries in which each *chaebol* was engaged for each sample year	5.57 (3.77)

Note that standard deviations are in parentheses.

* Observations in analysis are those observations after eliminating financial and banking firms and some marginal firms (157 firms) and non-information firms for the measurement of the diversification index (160 firms).

Table 4.2. The Correlation Matrix Between *Chaebol* Debt and Size

Variables	Debt	Asset	Sales
Debt	1.0000		
Asset	0.9470	1.0000	
Sales	0.9007	0.9696	1.0000

Table 4.3. Summary Statistics for Regression Variables

Variable	**Mean**	**Std. Div.**
Div (the Herfindahl Index)	0.474	0.222
Log of segment number (lnSeg)	2.169	0.672
Log of assets (lnAsset)	13.883	1.631
Debt/assets	0.632	0.479
Interest difference (ID)	0.022	0.030
Interest payment/debt (FC)	0.058	0.032

Note Div denotes the Herfindahl Index for diversification.

Table 4.4. Regression Results with the Herfindahl Index and *Chaebol* Fixed Effects

Independent Variables	Dependent Variable: The Herfindahl Index (DIV)		
	(1)	(2)	(3)
Constants	-0.249**	-0.430**	-0.638**
	(0.064)	(0.073)	(0.079)
lnAsset	0.047**	0.063**	0.079**
	(0.004)	(0.005)	(0.005)
Debt/Asset	0.087**	0.124**	0.074**
	(0.020)	(0.021)	(0.021)
ID		0.397**	0.339*
		(0.141)	(0.138)
FC		-1.214**	-0.791**
		(0.154)	(0.165)
Year Dummy			-0.068**
			(0.011)
Adj.R2	0.7663	0.7845	0.7940
Observation	910	910	910
F test	33.84	36.16	37.03

Note that standard deviations are in parentheses. ** and * denote 99% and 95% significance, respectively. ID is the average difference between market and DMB interest rates. FC is the interest payment divided by total debt.

Table 4.5. Regression Results with the Number of Segments and *Chaebol* Fixed Effects

Independent Variables	Dependent Variable: The Number of Segments (lnSeg)		
	(1)	(2)	(3)
Constants	-0.664**	-1.453**	-2.552**
	(0.156)	(0.202)	(0.204)
lnAsset	0.207**	0.258**	0.345**
	(0.012)	(0.013)	(0.014)
Debt/Asset	0.169**	0.294**	0.027
	(0.058)	(0.057)	(0.056)
ID		1.270**	0.964**
		(0.390)	(0.358)
FC		-4.046**	-1.821**
		(0.428)	(0.429)
Year Dummy			-0.357**
			(0.028)
Adj.R2	0.7663	0.7845	0.7940
Observation	910	910	910
F test	22.87	22.14	25.02

Note that standard deviations are in parentheses. ** denotes 99% significance. ID is the average difference between market and DMB interest rates. FC is the interest payment divided by total debt.

Table 4.6. Regression Results with the Herfindahl Index and *Chaebol* Random Effects

Independent Variables	Dependent Variable: The Herfindahl Index (DIV)		
	(1)	(2)	(3)
Constants	-0.265**	-0.436**	-0.624**
	(0.065)	(0.073)	(0.077)
lnAsset	0.048**	0.062**	0.078**
	(0.004)	(0.004)	(0.005)
Debt/Asset	0.087**	0.124**	0.073**
	(0.020)	(0.020)	(0.021)
ID		0.405**	0.327*
		(0.139)	(0.137)
FC		-1.209**	-0.791**
		(0.153)	(0.164)
Year Dummy			-0.067**
			(0.011)
R2	0.1925	0.2071	0.2326
Observation	910	910	910

Note that standard deviations are in parentheses. ** and * denote 99% and 95% significance, respectively. ID is the average difference between market and DMB interest rates. FC is the interest payment divided by total debt.

Figure 4.1

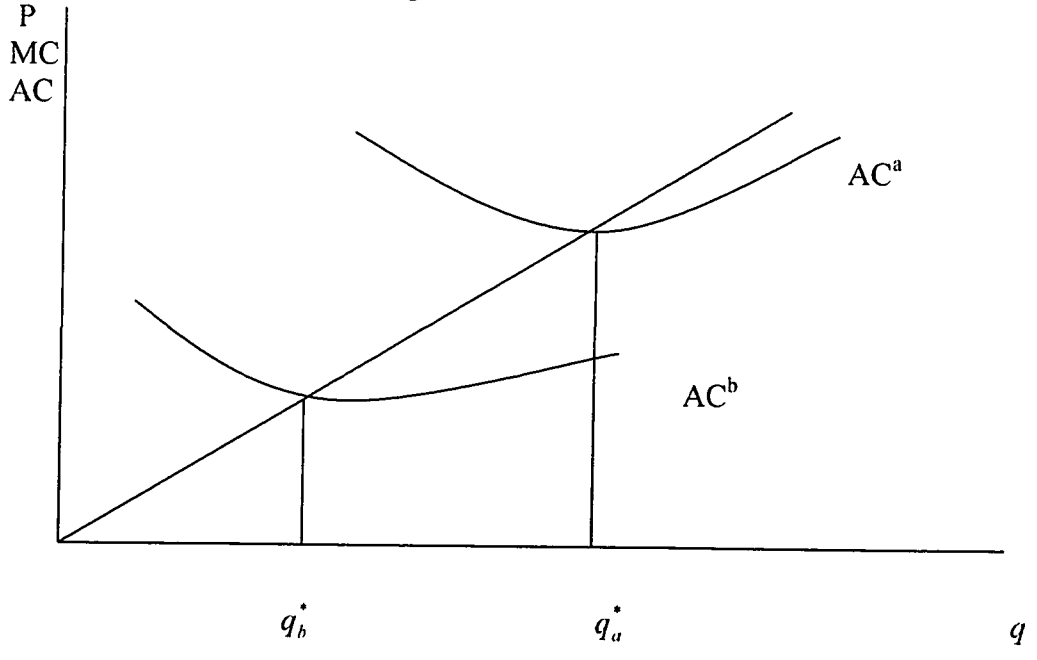
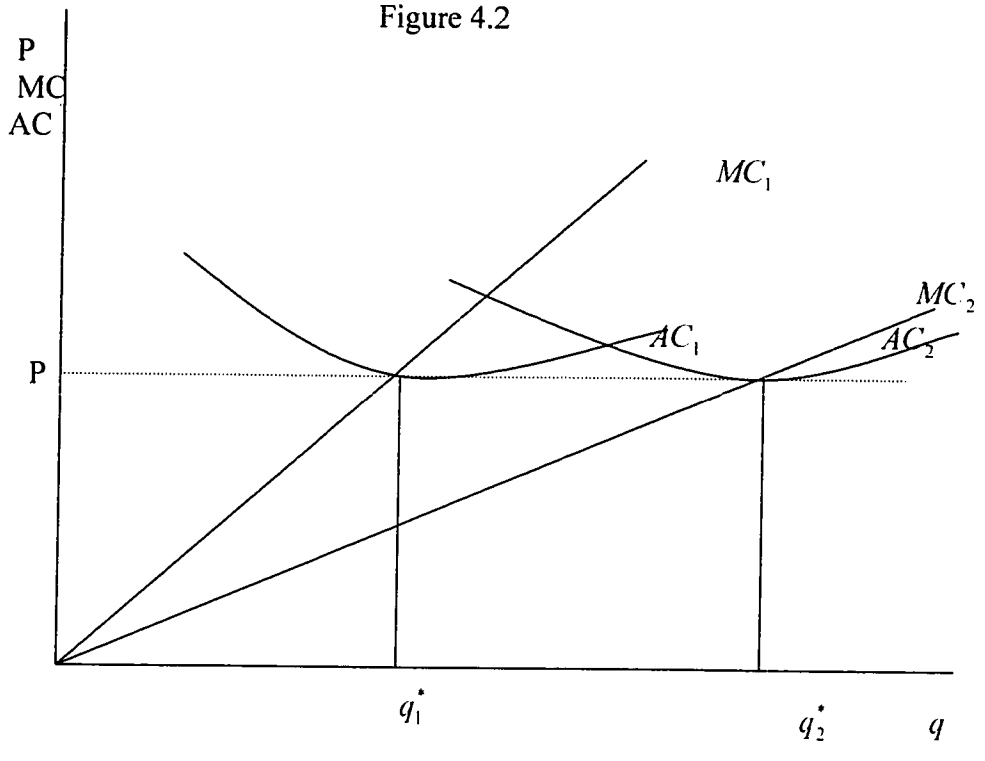


Figure 4.2



Chapter 5.
Chaebol Structure and Industry Productivity Growth in Korea

5.1. Introduction

Even though large business groups are commonly observed in many countries, the largest Korean business groups known as *chaebols* play a particularly large and important role in the Korean economy. *Chaebols* have specific characteristics that differ from business groups of other countries. Korean *chaebols* are very large and diversified horizontally as well as vertically with strong central control systems. In addition, *chaebols* have strong linkage to both the government and to special banks.

Starting in the late 1940s and 1950s, most of the largest *chaebols* grew rapidly under favorable policies of the Korean government. Government support, in the form of controlled exchange allocations, low interest loans, government construction contracts, import licenses, large-scale tax benefits, and export subsidies, was given to *chaebols*. With substantial government support and the use of diversification strategies, *chaebols* have come to play a significant role in economic development, dominate the Korean economy, and have gained increasing international recognition. According to data from the Fair Trade Commission in South Korea, the largest 30 *chaebols* have total sales equal to approximately 71%, 75%, and 76% of Korea's GDP in 1988, 1993, and 1996, respectively.

However, in spite of their growth, before and during the Asian financial crisis of 1997, the six largest *chaebols* went bankrupt, thus shocking the Korean economy greatly and resulting in its collapse (Krueger and Woo, 2001; Joh, 2001). Many argue that *chaebols* that had high debt and were broadly diversified played a very important role in leading to the Crisis. The rational given is that the overdiversification of

chaebols is widely believed to be an important source of inefficiency resulting in an industrial structure that was particularly susceptible to the financial shocks that occurred in the 1990s.

This chapter investigates the relationship between *chaebol* structure and industry performance. This analysis is accomplished by combining microeconomic information on Korean manufacturing firms with industry-level production data for the sample period 1988-1998. I provide evidence on how the level of diversification of Korean business groups affects industry performance. This paper concentrates on the hypothesis that diversification of *chaebols* has a negative impact on the level and growth of industry productivity.

In order to investigate the effects of *chaebols* on industry performance, I measure the diversification of *chaebols* using traditional diversification indices: the inverse of the number of industries in which a *chaebol* operates, the Herfindahl index, and the entropy index. I find that *chaebols* are highly diversified, but the diversification pattern varies across time. Before the Crisis, *chaebols* were becoming increasingly diversified. After the Crisis, diversification declined markedly.

Next, I examine the effect of this change in industrial structure on the level and growth of TFP and labor productivity. TFP and labor productivity are measured at the industry level disaggregated by employee size class. At the industry level, I test whether the structure of *chaebols* affects productivity and its growth. Two variables are used to measure the characteristics of *chaebols*-diversification index and the share of *chaebols* in an industry. The diversification index measures the diversification of all

chaebols at the three-digit SIC industry level and the labor input share indicates how important *chaebols* are in an industry.

I find that industries with higher levels of *chaebol* diversification have lower total factor productivity and lower total factor productivity growth. Alternatively, the relative importance of *chaebols*, measured as the labor share of *chaebols* in an industry, is relatively uncorrelated with the level and the growth of TFP. For robustness checks, the level and growth of industry labor productivity defined as value-added divided by the number of employees are also used as alternative productivity measures. As in the case of TFP analysis, the correlation between *chaebol* diversification and labor productivity is also negative. Overall, the results in this chapter are consistent with the view that overdiversification by Korean business groups has had a negative impact on economic performance. These findings are consistent with previous studies that found that diversification is negatively related to economic performance (Lichtenberg, 1992; Gollop, 1997; Lang and Stulz, 1994).

The rest of this chapter is organized as follows. Section 5.2 describes the theoretical background. Section 5.3 describes the data and the construction of variables for analysis. Section 5.4 reports the empirical analysis of TFP and TFP growth by combining *chaebol*-data on diversification with industry data on productivity. Section 5.5 provides the alternative analysis that provides robustness checks of the main results. Section 5.6 concludes the chapter.

5.2. The Theoretical Background

One of the most interesting issues in the study of industrial organization is the effect of diversification on performance. A large number of empirical studies have found a

negative relationship between diversification and performance.[11] The reasons for this negative relationship are both diversification itself and cross-subsidization. Mork, Shleifer, and Vishny (1988), in their study of a sample of 326 US acquisitions between 1975 and 1987, found a negative relationship between diversification and performance when firms made unrelated acquisitions. By supporting poor performing divisions, the practice of cross-subsidization through the internal capital markets by diversified firms fosters inefficiency (Sharfstein, 1997; Lamont, 1997; or Shin and Stulz, 1998). Many other studies have also found a negative relationship between diversification and firm performance (e.g., Berger & Ofeck, 1995; Lins & Servaes, 1999; and Lamont & Polk, 2000). Alternatively, some studies find a positive relationship when the focus is restricted to related diversification (Lecraw, 1984) and the presence of multimarket contracts in concentrated industries (Scott, 1993). Hubbard and Palia (1999) argue that diversifying acquisitions made positive abnormal returns in the 1960s when internal capital markets functioned better than external markets did.

However, few studies have investigated the relationship between diversification and productivity. Lichtenberg (1992) analyzes the relationship between diversification and total factor productivity (TFP) using plant-level Census Bureau data. He states that productivity is inversely related to diversification when he controls only for firm size. Gollop (1997) suggests that specialization of manufacturing plants is positively associated with plant-level total factor productivity. Recently, Vannoni (2000a) examined a sample of 119 firms operating in Italy in 1993 and found that integration

[11] Many studies have been conducted for that examines the effect of diversification on the value of the firm instead of the effect on productivity (Lang and Stulz, 1994; Berger and Ofeck, 1995). An excellent review of the literature is provided by Lang and Stulz (1994). They show that Tobin's q is negatively related to firm diversification in the 1980s.

strategies increase the level of total factor productivity, though the degree of diversification is not significantly related to productivity. In another analysis of the effects of corporate diversification on productivity using plant-level Census Bureau data, Schoar (2000) finds that diversification, as a corporate strategy, is negatively associated with total factor productivity. Although, she does find that newly diversified divisions within the same firm have higher productivity, on average, than specialized firms within their industries. In this study, I attempt to examine the correlation between the level of diversification in the largest Korean business groups, i.e., *chaebols*, and the level and growth of industry-level productivity in the Korean manufacturing sectors.

Theoretical and empirical studies have suggested that the phenomenon of diversification is associated with characteristics of the firm and industry structure, both of which have a systematic influence on industry performance.[12] Each firm makes a decision regarding entry, exit, or expansion based on its specific characteristics and profit opportunities both within and across industries. For instance, if a firm is in a fast-growing industry with high levels of profitability and high sunk entry costs, the firm may continue conducting business in the industry. However, if some obstacles exist, such as the presence of transaction costs, the firm may not be able to utilize its resources even though it has accumulated resources with rapid growth. In such a circumstance, a firm may accumulate a significant amount of underutilized resources. The firm has an incentive to utilize these resources. In many cases, the firm will attempt to pursue diversified expansion by entering new industries in which the firm can increase market share as long as diversification or expansion provides a way of

[12] William G. Shepherd (1970), Rhoades (1973), and Lecraw (1984) have explicitly treated diversification as an element of industry structure.

more profitably employing underused resources. Even though this expansion cannot guarantee profits, some firms may have an incentive to diversify by utilizing these accumulated resources instead of returning them to the owners. Consequently, the presence of accumulated, though underutilized resources may affect the type and the degree of diversification.

Many studies suggest that there are more varied advantages for large and diversified firms than for smaller or less diversified firms. Large-size firms in a given industry tend to be more efficient due to unobservable variables, such as outstanding managerial and labor skills, or scale economies, resulting in lower prices (Demsetz, 1973; Peltzman, 1977). Large diversified firms may offer a wide range of services using existing sales networks. They may also possess a good reputation with an existing brand name that is widely recognized, thus distinguishing their products from other smaller, or rival firms' products. Furthermore, they may have resources that are transferable to several activities, for example, in response to an increase in demand or price. These resources may create opportunities to realize economies of scope for large diversified firms, such as a cost advantage, by allowing them to distribute resources across processes, which may result in lower costs in the developing production and marketing of multiple goods (Teece, 1982; Levy, 1989). Wolf (1977) points out that utilizable resources may be exploited by the large and diversified firm in its product development, product marketing, and financing. Thus, firms endowed with substantial resources in comparison to smaller or specialized firms may have a wider range of investment opportunities. In these circumstances, diversifying firms may in fact be

more productive and hence one might find a positive relationship between diversification and productivity.

However, large diversified firms have some disadvantages compared to specialized or small firms. Large diversified firms may incur greater managerial costs than specialized firms. There are increased difficulties for parent firms associated with the management of large and complex affiliated divisions. They may also be inefficient due to cross-subsidizing poor performing divisions. It has been argued that diversified firms invest too much in their bad divisions and too little in their good divisions (Lamont, 1997; Scharfstein and Stein, 1997). A variety of evidence supports the conclusion that resources flow to inefficient divisions, i.e., diversified firms inefficiently transfer resources from good performing divisions to poor performing divisions (Berger & Ofek, 1995; Lamont, 1997; Rajan, Servaes, & Zingales, 2000). They misallocate their resources, resulting in a negative relationship between diversification and performance.

Another factor driving firms, particularly in Korea, to enter into unrelated industries and to maintain that presence is provided by the investment subsidies in the form of low interest loans, government construction contracts, and large-scale tax benefits. Political subsidies may increase market size as well as the resource level of the benefiting firms and industries, reducing firms' investment costs. As these policies encourage firms to enter new industries by subsidizing specific firms or industries, they also depress turnover as well as increase diversification even for inefficient firms. The Korean government has offered supporting programs to selected and protected firms in

many industries. This potential government subsidization of inefficient firms may have a significant influence on the negative performance of industries.[13]

In Korea, it has been argued that a main influence of the size, diversification, and structure of Korean business groups is the policies of the government in the allocation of capital. The Korean government controls banks and use their lending practices to manipulate interest rates, control credit, and channel domestic and foreign savings to Korean industrial firms. In the economic development plan of Korea, the government listed some key industries and selected some firms as beneficiaries. The selected firms received assistance and hence allocated a significant portion of the capital budget with interest rates lower than market interest rates (Joh, 2001). There are several reasons why the Korean government chose this industrial policy after the Korean War. First, capital formation was inadequate and Korean firms had little access to new technologies (Chung, Lee and Jung, 1997). South Korea was poorly endowed with natural resources and was supporting a large population. During the early industrialization periods, much of Korea's early domestic capital formation came from foreign aid and primarily targeted basic manufacturing industries, such as cement, fertilizer, and textiles. Second, only a small number of firms existed at the beginning of the industrialization period.[14] To develop a national economy, the government utilized and financed the existing firms, especially the *chaebols*. These "*chaebols*" developed close relationships with banks and the government. Regarding these relationships, Field (1995) reported as: "the majority of today's largest *chaebols*...got their start during the

[13] Krueger and Yoo (2001) have documented the importance of investment subsidies and industrial policies for *chaebols* in Korea and the influence of these policies on the financial crisis of 1997.
[14] For extreme example, as Field (1995, p.32) documented. "... by 1940 there were still only fourteen agricultural and ten industrial Korean-owned companies with capital exceedly 500,000 (Japanese) yen."

late 1940s and 1950s, ... the *chaebol* accumulated capital by using political connections..." (p.37). Because of these connections with the government, *chaebols* are able to access capital more easily than non-*chaebol* firms and at a lower cost. Thus, the *chaebols* benefited the most from subsidized bank credit and from the government-owned development funds and grew fast. As the Korean government has increasingly regulated the financial system over time, capital has been allocated more heavily toward *chaebol* firms and selected industries.

One problem with this approach to the allocation of capital is that it may create inefficiencies in the economy. If the government subsidies are heavily assigned to inefficient firms or encourage firms to overdiversify, it distorts the distribution of resources, systemically driving a negative performance in industries. Haggard and Mo (2000) argue that these policies resulted in an investment boom in the period 1994-1996. Investment in manufacturing facilities rose by an average 38.5% per year. They also pointed out that "... these distorted incentives in the financial sector allowed the *chaebols* to raise and invest unprecedented amounts of capital in 1994-1996"(p.208). As a result, the reckless government intervention in the financial sectors gave *chaebols* motivation for expansion. Similarly, Krueger and Yoo (2001) argue that the Korean government's financial policy had created crony capitalism before the Crisis. This skewed allocation system contributed to the weakness and inefficiency of the financial and banking systems and were the most probable factors leading to the Crisis.

Alternatively, the existence of large diversified firms may be a result of strong management. For example, Maksimovic and Phillips (2002) argued that a firm under good management might expand in several fields in which the firm has comparative

advantages. In this case, diversification and the market share of large and diversified firms are likely to be positively associated with the level and growth of industry productivity.

Hence, there are reasons why one might expect to see either a positive or negative correlation between performance and diversification. In fact, as I discussed in Chapter 3, the empirical findings regarding diversification and economic performance in the US are quite mixed. For Korea, however, one might expect the negative relationship to dominate because of the importance of the non-market allocation of capital to *chaebols*. These subsidies created by the government provide an incentive for the *chaebol* to expand both vertically and horizontally. In the remaining sections of the chapter, I explore these possibilities.

5.3. Data and the Construction of Variables

5.3.1. Data Sources

The manufacturing data used in this paper come from the Korean manufacturing census taken every five years. This data set includes industry-level data on manufacturing industries, where industries are defined according to the Korean Standard Industry Classification (SIC 15000~37999). The data are constructed by combining information on about 80,000 establishments, with more than five employees, for each census year. The data give detailed information on aggregate output, value-added, employment, tangible fixed assets (a proxy for capital), and other variables by employee size class. The data allow for the construction of an aggregate productivity measure for each industry, size class, and year. I use a sub-sample at the three-digit SIC level because most *chaebol* firms are only classified at the three-digit Korean SIC level.

Census data are available for the periods, 1988, 1993, and 1998. Table 5.1 reports sample information and basic statistics. The total number of all manufacturing industries at the three-digit SIC level is 61.

Even though the data at the firm level is usually very limited in the Newly Industrializing Countries in East Asia, the datasets of the Korean Economic Research Institute (KERI), National Information & Credit Evaluation (NICE), and LG Securities (LG) used for this study provide financial information regarding the largest business groups and nongroup firms. The KERI dataset has the advantage of identifying the 70 largest *chaebols* and their affiliated firms since 1986, and includes a set of financial variables. *Chaebol*-firms are identified as firms that belong to the Korean business groups if they are within the same ownership or under the control of a single parent firm. I augment the KERI data with NICE and LG databases to expand the financial information.[15] Even though some firms are classified at the 5-digit Korean SIC level, most firms have only 3-digit SIC codes. Thus, I can investigate the effect of *chaebol* firms on the productivity growth at the three-digit SIC level. Diversification is defined according to each group's activity in more than one industry at the three-digit SIC level.

As seen in Table 5.1, the 70 *chaebols* have 1,024 firms identified in manufacturing and nonmanufacturing industries at the three-digit SIC level during the sample period. Each *chaebol* has on average 14.63 firms and produces in 7.7 industries. Firms with primary SIC codes in the financial and banking industries (SIC 650-699) are not included in this study, because they are regulated and have different financial information (e.g., no sales), making comparisons difficult. After eliminating nonmanufacturing firms as well as financial and banking firms, the number of *chaebol*

[15] The three large-state own groups are excluded.

firms in manufacturing industries is 459 during the sample period. On average each *chaebol* has 6.96 firms and that produce in 3.78 manufacturing industries.

Among the 61 industries in manufacturing at the three-digit level, *chaebols* produce in 48 industries. There are also a few firms that do not provide an annual report or detailed financial data. These are not included in the analysis. For analyzing the diversification effect of *chaebols* on industry productivity growth, 420 firms are matched with the complete annual reports for the three sample periods. On average, each *chaebol* has 6.12 firms and is active in three to four industries.

5.3.2. The Measurement of Diversification Indices

In order to examine the correlation between the structure of Korean business groups and the level and growth of industry productivity, I will construct a diversification index. Because *chaebols* are typically characterized by horizontal diversification as well as vertical integration in a wide range of industries, the index should be sensitive to the *chaebols*' activities for manufacturing industries as well as for nonmanufacturing industries.

In order to understand how diversified *chaebols* are, I first measure the degree of diversification of 70 *chaebols* using traditional diversification indices at the two-digit SIC level. These indices include the inverse of the number of sectors, the Herfindahl index, and the entropy index. Berry (1971) used the Herfindahl index as a diversification index by applying the index's methodology to the distribution of a firm's industrial activity. The Herfindahl index has the form $\sum s_{ic}^2$, where s_{ic} is the share of the ith industry (or product) in total sales of *chaebol c*. The index of diversification for *chaebol c* can be written as:

$$(5.1) \quad HD_c = 1 - \sum s_{ic}^2$$

This index varies between zero and one. Perfect specialization, a single *chaebol*, yields a value of zero while for a very diversified *chaebol* the index will approach one. In addition, the more unequal the share sizes of the *chaebol c* in each industry are or the greater the number of industries it operates in, the larger the index will be. If the shares are equal across the industries of a *chaebol* operates in, the index simplifies to $HD_c = \mathrm{I} - \frac{1}{N_c}$, where N_c is the number of industries (or products) in which *chaebol c* produces. While the index satisfies most properties of a diversification index, it does not address product heterogeneity.[16] That is, how different the underlying industries are that make up the index.

The entropy index for diversification of *chaebol c* proposed by Jacquemin and Berry (1979) is as follows:

$$(5.2) \quad E_c = \sum s_{ic} \ln(1/s_{ic})$$

The index varies between zero to $\ln N_c$. If *chaebol c* is active in only a single industry, the entropy is zero. As the *chaebol* becomes more diversified, the index rises. The index increases as the number of industries rise or as the industry shares a firm operates in become more equal (holding number of industries constant).

Table 5.2 reports the average diversification of *chaebols* for each index. The second column of Table 5.2 is the average number of sectors in which each *chaebol* is engaged. The third and fourth columns of Table 5.2 are the Herfindahl index (HD) and the entropy index. The results are quite consistent across three measures of diversification.

[16] Gollop et al. discuss the Properties of each diversification index. See Gollop et al. (1991) in detail.

The large Korean business group level of diversification rose from 1986 to 1996 (the year preceding the Asian financial crisis). After the Crisis, diversification decreased sharply. The number based index (column 2) shows that the *chaebols* produce in, on average, 4.5 industries in 1986 to a peak of 7.6 in 1996 and subsequently fell back to an average of 5.3 in 2000. The Herfindahl index and entropy index show a similar pattern. The Herfindahl index increased by 39% from 1986 to 1996 and then fell sharply by 23% from 1996 to 2000.

For this study, I measure diversification at the *chaebol* level and industry level for each industry. I begin with the Herfindahl index for the degree of specialization, because it is sensitive to the number and distribution of industry shares produced by a business group. In addition, in order to measure the importance of *chaebols* in an industry, the share of the *chaebol* in terms of total labor of all *chaebols* in an industry is used to weight equation (5.1) and thus, the *chaebols*' diversification index (hereafter, CD) is written as

$$(5.3) \quad CD_i = 1 - \sum_{c=1}^{C} w_{ic} H_c \text{ , for c=1,2 ...,C}$$

where C is the total number of *chaebols* in the ith industry and $w_{ic} = \frac{l_{ic}}{L_{iC}}$ where l_{ic} is the labor of *chaebol* c at the ith industry and L_{iC} is the labor of all *chaebols* in the ith industry.

This diversification index accounts for the degree of the specialization of *chaebols* across all industries they operate in including both manufacturing and non-manufacturing. However, I only examine the impact of *chaebol* diversification on industry performance for the manufacturing sector.

In addition to the diversification of *chaebols*, I also examine how important *chaebols* are in the industry. For measuring the importance of *chaebols*, I use the *chaebols*' labor input share in the industry. This is constructed as

$$(5.4) \quad S_i = \frac{L_{iC}}{L_i}$$

where L_{iC} is the labor of all *chaebols* and L_i is the total labor in i^{th} industry.

Table 5.3 reports statistics as the diversification index (CD) and labor share (S) for *chaebols* for the major manufacturing industries. Note that the table is different from Table 5.2 in that it weights the diversification indices by labor shares. It also assumes that non-*chaebol* firms are specialized. The patterns of *chaebol* diversification observed in these data are more muted than in Table 5.2. However, the index still shows an increase in diversification in almost all industries from 1988 to 1993 and a decrease from 1993 to 1998 in most industries.

5.3.3. The Measurement of Total Factor Productivity and TFP Growth

To understand the contribution of *chaebols* to the level and growth of industry productivity, I measure the total factor productivity (TFP) at the three-digit manufacturing level using a neoclassical production function for which Q_{it} is the real gross output of the ith industry in year t as:

$$(5.5) \quad Q_{it} = F(K_{it}, L_{it}, M_{it})$$

where K_{it}, L_{it}, and M_{it} are capital, labor, and intermediate inputs, respectively. Since the objective is to measure the productivity at the aggregate industry level, I use the methodology of Jorgenson, Gollop, and Fraumeni (1987) based on the concept of value-added. Value-added is constructed as the difference between output and materials. The

value-added approach requires that capital and labor inputs and time are separable from the material input. Assuming that the production function is separable in materials, equation 5.5 can be rewritten as (assuming a Cobb-Douglas production function):

$$(5.6) \quad V_{it} = F(K_{it}, L_{it}) = AK_{it}^{\beta_1} L_{it}^{\beta_2}$$

After taking logarithms, we have:

$$(5.7) \quad \ln V_{it} = \ln A + \beta_1 \ln K_{it} + \beta_2 \ln L_{it}$$

where V_{it} is the value-added in the industry i at year t.

To measure the total factor productivity (TFP) of each industry at the three-digit industry level, I measure the residuals of equation 5.7, which can be written as:

$$(5.8) \quad \ln TFP_{it} = \ln V_{it} - \hat{\beta}_0 - \hat{\beta}_1 \ln K_{it} - \hat{\beta}_2 \ln L_{it}$$

The equation implies that the TFP for each aggregate industry and year is the estimated residual from these regressions. The TFP regressions also include a constant term, representing the idiosyncratic effect of productivity. I do not impose the restriction for constant return to scale for a log-linear Cobb-Douglas production function.

With regards to the measure of the specific variables, real value-added is constructed using two-digit producer price deflators indexed to 1995. Capital inputs are proxied as tangible fixed assets, deflated by the capital price index constructed by the Bank of Korea for total capital formation. Labor is defined as the average number of monthly employees. Because the Census data do not provide data for hours worked, I cannot directly measure TFP adjusted by hours worked. However, the department of labor provides data for hours worked at the two-digit industry level. Utilizing this data,

I attempt to estimate two measures of TFP at the three-digit industry level using the number of workers weighted by two-digit hours worked data.

5.3.4. Summary Statistics

In this section, I provide summary statistics of the log of TFP and TFP growth. Table 5.4 presents statistics for the regression variables used in the estimation of the production function 5.7. The TFP regressions are estimated with industry fixed effects. Equation 5.7 gives the results of the main specification below:

$$\ln V_{it} = \underset{(0.02)}{0.32}\ln L_{it} + \underset{(0.01)}{0.73}\ln K_{it} \qquad \text{Obs.=1228} \qquad \text{R2=0.9226.}$$

This estimate shows a larger capital share than labor share as other researchers have shown (e.g., Yuhn and Kwon, 2000). It is consistent with the views of many studies that have emphasized that capital inputs, which have accumulated rapidly, play a crucial role in the high performance in East Asian economies as well as the Korean economy (Kim and Lau, 1994; Young, 1995; Krugman, 1994).

Panel B shows three measurements of TFP growth by breaking the data into employee-size class. The first column is the unweighted growth of the log of TFP and the second column is the TFP growth measured by the adjusted labor inputs weighted by hours worked. Recall, the industry level data are disaggregated by employee size class. Table 5.4 indicates that the average value of TFP growth for each industry is 0.068, implying a 1.36% increase in TFP growth for the annual average.

Many previous studies have performed a similar measurement of the growth of TFP for the Korean economy. Young (1995) performed a growth accounting analysis for East Asian economies. In his study, the annual growth rate of TFP for the Korean

manufacturing industry is 3% for the period 1966-90. Timmer and Ark (forthcoming) measure the growth of TFP for the Korean economy using capital stock and capital services for the period 1963-96. They measured capital inputs in terms of aggregate stock and service flows. The growth rates of TFP are 0.83% and 0.51% for capital stock and capital service flows, respectively. Timmer and Ark also report the growth rates of TFP during the period 1985-96 for the two capital input measurements are 2.27% and 2.21%. Alternatively, Kim and Lau (1994) measure the TFP of the Korean economy and the annual growth rate of TFP at 1.2% for 1966-90 period. The measurements of growth rates of TFP from many studies differ widely as a result of utilizing different methodology and sample periods.[17] However, the estimate reported here at (1.36%) is certainly in the middle of reported range of other authors.

In Panel B, the three TFP growth measure are disaggregated into eight size classes to investigate whether different size firms may have different TFP growth patterns. That is, it can be that smaller firms have low TFP, while larger firms have high level of TFP if larger firms tend to be more efficient due to advantages of unobservable variables, e.g., managerial talent, lowering production cost as Demsetz (1973) and Peltzman (1977) have argued. The Panel B shows that lnTFP growth and lnTFP adjusted for hours worked are very similar to each other in the growth rates both overall and across size class levels. There is no systematic pattern across the size classes for either of the TFP growth variables.

[17] Many other studies measured TFP for Korean economy. See Felipe (1997) in detail.

5.4. The Empirical Analysis

5.4.1. The Empirical Model

In this section, I present a regression analysis that describes the relationship between *chaebol* diversification and the level and growth of industry TFP. In order to examine this relationship, I specify a basic regression model of the following form:

$$(5.9) \quad y_{it} = M_{it} b + e_t$$

where i represents i^{th} industry, y_{it} is the productivity and its growth, M_{it} is a matrix of observable characteristic indicators, b is a parameter vector, and e_t is the residual of the regression.

In order to investigate the effects of *chaebol* diversification on industry performance, I employ two dependent variables for y_{it} : total factor productivity and its growth rate. TFP is measured as in equation (5. 8). The characteristics in M_{it} include the diversification index CD_{it} (from equation 5.3), the total labor share of the *chaebol* S_{it} (equation 5.4), and the interactive variable of the *chaebol* $CD_{it} \times S_{it}$. The empirical specification also includes controls for employee size Z_{it} (a set of seven size class dummies) and industry fixed effects. Using these variables, equation 5.9 may be written as a basic regression model:

$$(5.10) \quad Y_{it} = a_i + b_1 Z_{it} + b_2 CD_{it} + b_3 S_{it} + b_4 (CD_{it} \times S_{it}) + e_t$$

where a_i is industry effect and e_t is the error term.

The specification includes two control variables that measure the importance and diversification of *chaebols* in an industry. The labor share variable attempts to quantify the importance of the presence of *chaebols* in an industry on TFP and TFP

growth. The diversification variable attempts to measure the impact of *chaebol* diversification on TFP and TFP growth. If overdiversification leads to inefficient production, then industries that are populated by very diversified *chaebols* may experience reduced productivity and productivity growth. In this case, we would expect that productivity would decline as diversification increases. An interaction term (CD*S) is included to capture the possibility that in sectors with large *chaebols*' shares, diversification may have a particularly large impact on economic performance.

5.4.2. Empirical Results

The results of the TFP regression analysis are presented in Tables 5.5 through 5.8. As stated above, the specifications include industry fixed effects and hence rely on the within industry variation to identify the parameters. The base specification also includes a set of dummy variables to control for size class. I first present a specification with only the diversification in order to see the simple effect of diversification without the interactions of *chaebol* share terms. Examining the first column of Table 5.5, I find that diversification is negatively related to the level of TFP in the industry. Industries that have *chaebols* with high levels of diversification have lower productivity. This agrees with many of the previous studies that found that diversification was negatively associated with economic performance (e.g., Lichtenberg, 1992; Lang and Stulz, 1994).

The next column includes only the *chaebol* share variable. Here, I find no effect of *chaebol* share on industry productivity. The last two columns incorporate both variables and include the interaction. In each case, only the diversification variable is statistically significant and there is little impact on the magnitude or significance of the diversification result. The result is that higher levels of *chaebol* diversification are

associated with lower levels of TFP. The other variable in the regression, the size class dummies, are statistically, significantly, and generally positive. The positive sign indicates that the larger size classes have higher TFP than the smaller size classes. However, the pattern of coefficients is not monotonic.

Table 5.6 is similar in structure to Table 5.5 but it also includes time dummies in the base model. These time dummies will control for overall trend in productivity. Note that one could argue that diversification affects the overall trend and that is why I have presented both the results with and without time effects. The overall results are very similar to those presented in Table 5.5. Of the main variables of interest, only the diversification variable matters. The sign is the same (negative) but the magnitude of the effects is somewhat reduced. Looking at the time trend, we see higher productivity in the 1998 period as compared to the earlier years. However, the key point here is that even after controlling for trend change in productivity, increasing diversification of *chaebols* had a negative impact on industry productivity.

While the level of productivity is certainly important, we are also concerned with how diversification is related to productivity change. My next set of results repeats the analysis but looks at productivity growth for the two five-year periods-1988 to 1993 and 1993 to 1998. Again, the data utilized are industry level-size group data. The structure of Table 5.7 and 5.8 is the same as Table 5.5 and 5.6. The results are very similar to the levels of regressions with regard to the *chaebol*-size group data. The diversification variable is negative and statistically significant, indicating that industries with higher business group diversification have lower TFP growth. Moreover, the *chaebol* share and the interaction are again not statistically significant in these regressions. These

patterns hold true for both sets of regressions (with and without the time period dummy). Finally, in all regressions, I report the tests the significance of the fixed industry effects with an F test. The observed F values are statistically significant and large, implying the fixed industry effects matter in the base specifications.

Alternatively, I also test for *chaebol* effects on TFP growth measured by adjusted labor inputs using hours worked multiplied by the average number of monthly employees. I report the results in Table 5.1.A. The results are very similar to the effect on TFP growth with the number of workers.

Overall, the TFP results show a robust pattern. Higher levels of *chaebol* diversification are associated with lower industry productivity and lower industry productivity growth. The share of the *chaebols* in the industry, however, is uncorrelated with industry performance.

5.5. Alternative Analysis

The previous section focused on examining changes in *chaebol* diversification on the level and growth of industry TFP. In this sub-section, I will perform robustness checks of the main results with an alternative productivity measure because the analysis based on TFP is sensitive to the characterization of the production structure. Total factor productivity measured by the error term in equation 5.8 may be influenced by strong assumptions about the underlying specification of the production function. To perform robustness checks, the log of industry labor productivity and its growth are used as alternative productivity measures. The log of labor productivity is defined as the logarithm of value-added divided by the number of employees in each size class level.

Table 5.9 and 5.10 is similar in structure to Table 5.5 and 5.6 (with and without time period dummies), but includes a capital-labor ratio as an additional control variable and labor productivity as a dependent variable instead of industry TFP. The overall results are very similar to those presented in Table 5.5 and 5.6. The sign on diversification is the same but the magnitude of the effects is somewhat reduced while *chaebol* share has again no impact on labor productivity. Moreover, the interactions that are not statistically significant are the same. In each case, the capital-labor ratios, size class, and time dummy variables are statistically significant and positive.

The next set of analyses re-estimates the regressions in the same structure in Table 5.7 and 5.8 but looks at the effects of *chaebol* diversification on labor productivity growth including the growth of a capital-labor ratio. As seen in Table 5.11 and 5.12, the diversification variable is negative and statistically significant, confirming that industries that have *chaebols* with high level of diversification had lower labor productivity growth. Again, the *chaebol* share and interaction are not statistically significant in these regressions (with and without the time period dummy). Of the size dummies, the size 7 dummy variable becomes significant. Moreover, the capital-labor variable is statistically significant and large, indicating that industries that have higher capital-labor growth have higher labor productivity growth. Taken together, the results from these robustness checks provide further evidence that the higher levels of *chaebol* diversification are correlated with lower industry performance.

5.6. Summary and Conclusion

This chapter explores how the structure of *chaebols* relates to industry performance in terms of total factor productivity, labor productivity, and their growth at

the three-digit SIC manufacturing industry level. I test the hypothesis that diversification of *chaebols* has a negative impact on the level and growth of industry productivity. In order to investigate the *chaebol* effect on industry productivity growth, I measure the degree of diversification of *chaebols* using traditional diversification indices and find that *chaebols* are highly diversified. However, while *chaebol* diversification increased markedly from 1986 to 1996, it fell sharply after the financial crisis.

The regression analysis shows that *chaebol* diversification is negatively related to the level of productivity and productivity growth in the manufacturing sectors. This is true whether one examines total factor productivity and its growth or labor productivity and its growth. The findings are also consistent across a range of specifications. Alternatively, the share of *chaebol* in an industry does not affect productivity.

Overall the results are consistent with the findings of those of Lichtenberg (1992) and Gollop (1997) which report on the relationship between industrial diversification and TFP in the US and Lee and Han (1998) that examines firm-level profitability for the 30 largest Korean *chaebols*. These studies show the negative relationship between diversification and firm performance. Alternatively, the results are quite different than that of Chang and Choi (1988) that showed a positive relationship between *chaebol* diversification and profits during 1975-1984 period. Note, however, that the period understudy in Chang and Choi precedes the period of study here. The bottom line of my study is that higher levels of *chaebol* diversification are negatively correlated with industry performance.

Table 5.1. Sample Information and Basic Statistics

Sample Periods: 1988, 1993, and 1998	
Number of Manufacturing Industries	61
In All Industries	
Number of *Chaebols*, i.e., the largest Korean business groups	70
Number of *chaebol* firms, i.e., the affiliated firms of *chaebols*	1024
Average number of *chaebol* firms of each *chaebol*	14.63 (10.33)
Average number of industries in which each *chaebol* is engaged	7.74 (5.44)
In The Manufacturing Industries	
Total number of manufacturing industries engaged by the *chaebols*	48
Number of *chaebol* firms	459
Average number of firms of each *chaebol*	6.96 (4.90)
Average number of manufacturing industries in which each *chaebol* is engaged	3.78 (2.57)
Observations in Analysis*	
Number of *chaebol* firms in Analysis	420
Average number of firms of each *chaebol* in manufacturing after eliminating missing-data firms	6.12 (4.77)
Average number of manufacturing industries in which each *chaebol* is engaged after eliminating missing-data firms	3.51 (2.40)

Note that three large state-own *chaebols* are excluded for *chaebol* firms.
Standard deviations are in parenthesis.
* After eliminating either firms that do not have any financial information or firms that do not have information for variables for measuring the diversification index.

Table 5.2. Average Diversification Index for the 70 *Chaebols* with Traditional Indices

Year	1/N	Herfindahl (HD)	Entropy (E)
1986	0.22119	0.36859	0.70001
1987	0.21765	0.37433	0.71659
1988	0.21664	0.39766	0.75852
1989	0.21664	0.39405	0.76268
1990	0.20214	0.39900	0.77717
1991	0.20321	0.41214	0.80493
1992	0.19272	0.42084	0.82786
1993	0.18136	0.42679	0.84660
1994	0.16633	0.45453	0.91891
1995	0.15350	0.48034	0.98186
1996	0.13012	0.51240	1.05756
1997	0.16572	0.47753	0.96889
1998	0.18946	0.41720	0.83698
1999	0.18267	0.40392	0.83609
2000	0.18724	0.39282	0.80047

Note: N is the number of industries at the two-digit SIC level in which *chaebols* are engaged.

Table 5.3. The Measurement of the CD index and Share

Industry	1988		1993		1998	
	CD	S	CD	S	CD	S
Average for all manufacturing	0.58	0.20	0.58	0.23	0.55	0.21
Food & Beverages	0.49	0.30	0.53	0.35	0.50	0.32
Textiles	0.54	0.05	0.57	0.06	0.38	0.06
Coke, refined petroleum & nuclear fuel	0.70	0.56	0.73	0.85	0.73	0.82
Chemicals	0.54	0.53	0.59	0.61	0.52	0.45
Other Non-metallic Mineral	0.45	0.23	0.50	0.23	0.47	0.28
Basic Metals	0.47	0.21	0.54	0.24	0.49	0.22
Computers & Office Machinery	0.48	0.21	0.46	0.19	0.49	0.13
Electrical Machinery	0.62	0.15	0.65	0.29	0.60	0.19
Electronic Communication Equipment	0.61	0.31	0.65	0.53	0.61	0.46
Motor Vehicles, Trailers & semitrailers	0.58	0.45	0.59	0.54	0.60	0.63
Other Transport Equipment	0.70	0.71	0.75	0.60	0.72	0.51

Note that CD and S denote the diversification index and the labor input share of *chaebols* respectively.

Table 5.4. Summary Statistics on TFP and TFP Growth

Panel A

Variables	Industry		*Chaebol* firm	
	Observation	Mean	Observation	Mean
Log of value-added	1228	11.334 (1.634)	794	12.099 (1.833)
Log of capital	1228	11.162 (1.830)	794	10.572 (2.108)
Log of labor	1228	8.070 (1.324)	794	6.516 (1.5442)

Panel B

Size Class	Obs.	ΔlnTFP	ΔlnADTFP
Overall Mean	777	0.068 (0.418)	0.069 (0.421)
Worker 5-9	109	0.068 (0.389)	0.073 (0.391)
Worker 10-19	110	0.104 (0.363)	0.107 (0.363)
Worker 20-49	111	0.066 (0.289)	0.068 (0.287)
Worker 50-99	104	0.084 (0.326)	0.086 (0.327)
Worker 100-199	97	0.049 (0.390)	0.050 (0.392)
Worker 200-299	85	0.050 (0.518)	0.051 (0.524)
Worker 300-499	76	0.013 (0.592)	0.013 (0.579)
Worker 500 & more	85	0.086 (0.499)	0.086 (0.501)

Note that standard deviations are in parenthesis. ΔlnTFP is the simple growth of lnTFP. ΔlnADTFP is the lnTFP growth measured by the adjusted labor inputs weighted by hours worked.

Table 5.5. *Chaebol* Diversification and Industry TFP

Independent variables	Dependent Variable: lnTFP							
	(1)		(2)		(3)		(4)	
Constant	0.1328		-0.1971	**	0.1290		0.0444	
	(0.0963)		(0.0392)		(0.0988)		(0.1146)	
Size1	0.1054	**	0.1054	**	0.1054	**	0.1053	**
	(0.0387)		(0.0390)		(0.0387)		(0.0387)	
Size2	0.1420	**	0.1422	**	0.1420	**	0.1419	**
	(0.0386)		(0.0388)		(0.0386)		(0.0386)	
Size3	0.2675	**	0.2677	**	0.2675	**	0.2675	**
	(0.0387)		(0.0389)		(0.0387)		(0.0387)	
Size4	0.2566	**	0.2575	**	0.2567	**	0.2567	**
	(0.0396)		(0.0399)		(0.0396)		(0.0396)	
Size5	0.3103	**	0.3118	**	0.3105	**	0.3108	**
	(0.0402)		(0.0404)		(0.0402)		(0.0402)	
Size6	0.2495	**	0.2513	**	0.2497	**	0.2502	**
	(0.0405)		(0.0408)		(0.0406)		(0.0405)	
Size7	0.2004	**	0.2013	**	0.2005	**	0.2009	**
	(0.0398)		(0.0400)		(0.0398)		(0.0398)	
CD	-0.5778	**			-0.5796	**	-0.4631	**
	(0.1610)				(0.1614)		(0.1802)	
S			-0.0065		0.0195		0.8163	
			(0.1129)		(0.1124)		(0.5603)	
CD*S							-1.1777	
							(0.8114)	
Adj.R2	0.2926		0.2833		0.2919		0.2927	
Observation	1033		1033		1033		1033	
F test	8.29		7.93		8.28		8.13	

** denotes 99% significance. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Table 5.6. *Chaebol* Diversification and Industry TFP with Year Controls

Independent variables	Dependent Variable: lnTFP							
	(1)		(2)		(3)		(4)	
Constant	0.0117		-0.2187	**	0.0039		-0.0170	
	(0.0978)		(0.0397)		(0.1003)		(0.1145)	
Size1	0.1054	**	0.1054	**	0.1053	**	0.1053	**
	(0.0382)		(0.0383)		(0.0382)		(0.0382)	
Size2	0.1427	**	0.1429	**	0.1427	**	0.1427	**
	(0.0381)		(0.0382)		(0.0381)		(0.0381)	
Size3	0.2676	**	0.2677	**	0.2676	**	0.2676	**
	(0.0382)		(0.0383)		(0.0382)		(0.0382)	
Size4	0.2592	**	0.2603	**	0.2595	**	0.2595	**
	(0.0391)		(0.0392)		(0.0391)		(0.0391)	
Size5	0.3125	**	0.3140	**	0.3129	**	0.3129	**
	(0.0396)		(0.0397)		(0.0397)		(0.0397)	
Size6	0.2541	**	0.2559	**	0.2545	**	0.2546	**
	(0.0400)		(0.0401)		(0.0400)		(0.0400)	
Size7	0.2064	**	0.2075	**	0.2066	**	0.2067	**
	(0.0393)		(0.0394)		(0.0393)		(0.0393)	
Year93	-0.0424		-0.0540	*	-0.0441		-0.0413	
	(0.0243)		(0.0244)		(0.0247)		(0.0258)	
Year98	0.0887	**	0.0914	**	0.0877	**	0.0880	**
	(0.0246)		(0.0248)		(0.0248)		(0.0248)	
CD	-0.3939	*			-0.3960	*	-0.3686	*
	(0.1636)				(0.1638)		(0.1789)	
S			0.0306		0.0403		0.2550	
			(0.1133)		(0.1131)		(0.5753)	
CD*S							-0.3208	
							(0.8428)	
Adj.R2	0.3113		0.3072		0.3106		0.3100	
Observation	1033		1033		1033		1033	
F test	8.45		8.27		8.43		8.19	

** and * denote 99% and 95% significance, respectively. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Table 5.7. *Chaebol* Diversification and Industry TFP Growth

Independent variables	Dependent Variable: lnTFP Growth			
	(1)	(2)	(3)	(4)
Constant	0.7596 **	0.0506	0.7472 **	0.7370 **
	(0.1571)	(0.0671)	(0.1611)	(0.1890)
Size1	0.0321	0.0318	0.0321	0.0321
	(0.0588)	(0.0599)	(0.0588)	(0.0589)
Size2	0.0071	0.0069	0.0071	0.0071
	(0.0585)	(0.0596)	(0.0586)	(0.0586)
Size3	0.0057	0.0057	0.0057	0.0057
	(0.0586)	(0.0597)	(0.0587)	(0.0587)
Size4	-0.0003	-0.0015	0.0001	0.0001
	(0.0605)	(0.0616)	(0.0605)	(0.0606)
Size5	0.0004	0.0018	0.0009	0.0009
	(0.0621)	(0.0633)	(0.0622)	(0.0623)
Size6	-0.0095	-0.0098	-0.0090	-0.0089
	(0.0629)	(0.0640)	(0.0629)	(0.0630)
Size7	0.0519	0.0486	0.0523	0.0523
	(0.0616)	(0.0628)	(0.0617)	(0.0618)
CD	-1.2443 **		-1.2543 **	-1.2404 **
	(0.2630)		(0.2647)	(0.2972)
S		-0.0312	0.0712	0.1638
		(0.2039)	(0.2016)	(0.9168)
CD*S				-0.1342
				(1.2971)
Adj.R2	0.0705	0.0367	0.0692	0.0677
Observation	670	670	670	670
F test	1.89	1.68	1.87	1.86

** denotes 99% significance. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Table 5.8. *Chaebol* Diversification and Industry TFP Growth with Year Controls

Independent variables	Dependent Variable: lnTFP Growth			
	(1)	(2)	(3)	(4)
Constant	0.4264 **	-0.0843	0.3976 *	0.5333 **
	(0.1655)	(0.0680)	(0.1700)	(0.1876)
Size1	0.0318	0.0316	0.0318	0.0319
	(0.0575)	(0.0579)	(0.0575)	(0.0574)
Size2	0.0074	0.0075	0.0074	0.0074
	(0.0572)	(0.0576)	(0.0572)	(0.0571)
Size3	0.0067	0.0068	0.0067	0.0068
	(0.0573)	(0.0577)	(0.0573)	(0.0572)
Size4	0.0027	0.0032	0.0037	0.0043
	(0.0591)	(0.0596)	(0.0591)	(0.0591)
Size5	0.0031	0.0054	0.0043	0.0043
	(0.0608)	(0.0612)	(0.0608)	(0.0607)
Size6	0.0010	0.0036	0.0023	0.0025
	(0.0615)	(0.0619)	(0.0615)	(0.0614)
Size7	0.0609	0.0613	0.0621	0.0631
	(0.0603)	(0.0608)	(0.0603)	(0.0602)
Year 98	0.1720 **	0.2019 **	0.1738 **	0.1919 **
	(0.0317)	(0.0307)	(0.0318)	(0.0335)
CD	-0.8156 **		-0.8324 **	-1.0252 **
	(0.2690)		(0.2700)	(0.2922)
S		0.1016	0.1512	-1.4128
		(0.1983)	(0.1975)	(0.9353)
CD*S				2.2805
				(1.3331)
Adj.R2	0.1115	0.1741	0.1109	0.1137
Observation	670	670	670	670
F test	1.87	1.88	1.86	1.91

** denotes 99% significance. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Table 5.9. *Chaebol* Diversification and Industry Labor Productivity

Independent variables	Dependent Variable: the log of labor productivity							
	(1)		(2)		(3)		(4)	
Constant	1.1904	**	0.8741	**	1.1879	**	1.1124	**
	(0.1007)		(0.0457)		(0.1023)		(0.1188)	
Size1	0.1281	**	0.1282	**	0.1281	**	0.1281	**
	(0.0388)		(0.0390)		(0.0388)		(0.0388)	
Size2	0.1941	**	0.1942	**	0.1941	**	0.1939	**
	(0.0387)		(0.0389)		(0.0387)		(0.0387)	
Size3	0.3111	**	0.3110	**	0.3111	**	0.3108	**
	(0.0388)		(0.0390)		(0.0388)		(0.0388)	
Size4	0.3079	**	0.3084	**	0.3082	**	0.3077	**
	(0.0400)		(0.0403)		(0.0401)		(0.0400)	
Size5	0.3374	**	0.3383	**	0.3376	**	0.3374	**
	(0.0406)		(0.0409)		(0.0407)		(0.0406)	
Size6	0.2831	**	0.2843	**	0.2835	**	0.2833	**
	(0.0411)		(0.0414)		(0.0412)		(0.0412)	
Size7	0.2982	**	0.2983	**	0.2985	**	0.2979	**
	(0.0409)		(0.0412)		(0.0409)		(0.0409)	
ln(K/L)	0.6982	**	0.6990	**	0.6980	**	0.6989	**
	(0.0097)		(0.0099)		(0.0098)		(0.0098)	
CD	-0.5518	**			-0.5534	**	-0.4522	*
	(0.1612)				(0.1617)		(0.1808)	
S			-0.0105		0.0161		0.7036	
			(0.1141)		(0.1138)		(0.5618)	
CD*S							-1.0184	
							(0.8150)	
Adj.R2	0.8813		0.8799		0.8812		0.8812	
Observation	1033		1033		1033		1033	
F test	6.64		6.32		6.63		6.57	

** and * denote 99% and 95% significance, respectively. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Table 5.10. *Chaebol* Diversification and Industry Labor Productivity with Year Controls

Independent variables	Dependent Variable: the log of labor productivity							
	(1)		(2)		(3)		(4)	
Constant	1.5784	**	1.3568	**	1.5716	**	1.5460	**
	(0.0935)		(0.0490)		(0.0954)		(0.1072)	
Size1	0.1263	**	0.1264	**	0.1263	**	0.1263	**
	(0.0339)		(0.0340)		(0.0339)		(0.0339)	
Size2	0.2411	**	0.2412	**	0.2411	**	0.2411	**
	(0.0339)		(0.0340)		(0.0339)		(0.0339)	
Size3	0.4218	**	0.4218	**	0.4218	**	0.4218	**
	(0.0346)		(0.0347)		(0.0346)		(0.0346)	
Size4	0.5261	**	0.5271	**	0.5265	**	0.5265	**
	(0.0373)		(0.0374)		(0.0373)		(0.0373)	
Size5	0.5566	**	0.5579	**	0.5570	**	0.5570	**
	(0.0378)		(0.0380)		(0.0378)		(0.0379)	
Size6	0.5641	**	0.5658	**	0.5647	**	0.5648	**
	(0.0396)		(0.0398)		(0.0397)		(0.0397)	
Size7	0.6951	**	0.6961	**	0.6956	**	0.6957	**
	(0.0428)		(0.0430)		(0.0429)		(0.0429)	
ln(K/L)	0.3366	**	0.3367	**	0.3364	**	0.3364	**
	(0.0232)		(0.0233)		(0.0232)		(0.0232)	
Year93	0.5216	**	0.5104	**	0.5205	**	0.5239	**
	(0.0398)		(0.0399)		(0.0400)		(0.0405)	
Year98	1.0016	**	1.0040	**	1.0012	**	1.0016	**
	(0.0589)		(0.0591)		(0.0590)		(0.0590)	
CD	-0.3791	**			-0.3810	**	-0.3476	*
	(0.1452)				(0.1453)		(0.1587)	
S			0.0274		0.0367		0.2985	
			(0.1006)		(0.1004)		(0.5105)	
CD*S							-0.3910	
							(0.7478)	
Adj.R2	0.9092		0.9086		0.9092		0.9091	
Observation	1033		1033		1033		1033	
F test	8.72		7.66		7.81		7.81	

** and * denote 99% and 95% significance, respectively. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Table 5.11. *Chaebol* Diversification and Industry Labor Productivity Growth

Independent variables	Dependent Variable: the growth of the log of labor productivity			
	(1)	(2)	(3)	(4)
Constant	0.8485 **	0.5807 **	0.8136 **	0.9490 **
	(0.1209)	(0.0561)	(0.1238)	(0.1451)
Size1	0.0523	0.0528	0.0524	0.0527
	(0.0452)	(0.0453)	(0.0452)	(0.0451)
Size2	0.0445	0.0456	0.0446	0.0450
	(0.0451)	(0.0452)	(0.0450)	(0.0450)
Size3	0.0444	0.0456	0.0446	0.0451
	(0.0452)	(0.0453)	(0.0451)	(0.0451)
Size4	0.0562	0.0585	0.0576	0.0584
	(0.0466)	(0.0467)	(0.0466)	(0.0465)
Size5	0.0781	0.0821	0.0799	0.0803
	(0.0480)	(0.0481)	(0.0480)	(0.0479)
Size6	0.0561	0.0594	0.0579	0.0578
	(0.0485)	(0.0486)	(0.0485)	(0.0484)
Size7	0.1131 *	0.1154 *	0.1148 *	0.1156 *
	(0.0476)	(0.0477)	(0.0476)	(0.0475)
dln(K/L)	0.2059 **	0.1942 **	0.2042 **	0.2002 **
	(0.0254)	(0.0250)	(0.0254)	(0.0255)
CD	-0.4107 *		-0.4366 *	-0.6150 **
	(0.2061)		(0.2070)	(0.2296)
S		0.1713	0.2026	-1.0210
		(0.1547)	(0.1550)	(0.7043)
CD*S				1.7765
				(0.9976)
Adj.R2	0.2035	0.1999	0.2044	0.2072
Observation	670	670	670	670
F test	2.68	2.80	2.68	2.75

** and * denote 99% and 95% significance, respectively. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share. dln(K/L) is the growth of the log of the ratio of capital to labor.

Table 5.12. *Chaebol* Diversification and Industry Labor Productivity Growth with Year Controls

Independent variables	Dependent Variable: the growth of the log of labor productivity			
	(1)	(2)	(3)	(4)
Constant	1.1477 **	0.7324 **	1.1169 **	1.1290 **
	(0.1319)	(0.0650)	(0.1352)	(0.1475)
Size1	0.0569	0.0569	0.0569	0.0569
	(0.0443)	(0.0447)	(0.0443)	(0.0444)
Size2	0.0521	0.0525	0.0522	0.0521
	(0.0442)	(0.0445)	(0.0442)	(0.0442)
Size3	0.0520	0.0525	0.0520	0.0520
	(0.0443)	(0.0446)	(0.0443)	(0.0443)
Size4	0.0648	0.0660	0.0659	0.0658
	(0.0457)	(0.0461)	(0.0457)	(0.0458)
Size5	0.0903	0.0931	0.0916	0.0915
	(0.0471)	(0.0475)	(0.0471)	(0.0472)
Size6	0.0606	0.0636	0.0620	0.0619
	(0.0476)	(0.0479)	(0.0476)	(0.0476)
Size7	0.1195 *	0.1207 *	0.1207 *	0.1208 *
	(0.0467)	(0.0470)	(0.0467)	(0.0467)
dln(K/L)	0.1274 **	0.1232 **	0.1269 **	0.1275 **
	(0.0292)	(0.0294)	(0.0292)	(0.0293)
Year98	-0.1478 **	-0.1253 **	-0.1461 **	-0.1441 **
	(0.0286)	(0.0282)	(0.0287)	(0.0303)
CD	-0.6562 **		-0.6738 **	-0.6920 **
	(0.2075)		(0.2082)	(0.2262)
S		0.1197	0.1594	0.0129
		(0.1529)	(0.1522)	(0.7255)
CD*S				0.2135
				(1.0339)
Adj.R2	0.2354	0.2237	0.2355	0.2343
Observation	670	670	670	670
F test	2.85	2.86	2.83	2.83

** and * denote 99% and 95% significance, respectively. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share. dln(K/L) is the growth of the log of the ratio of capital to labor.

Table 5.1.A. *Chaebol* Diversification and Industry TFP Growth (adjusted by hours worked)

Independent variables	Dependent Variable: lnTFP Growth			
	(1)	(2)	(3)	(4)
Constant	0.4394 **	-0.0821	0.4063 *	0.5547 **
	(0.1666)	(0.0685)	(0.1712)	(0.1888)
Size1	0.0298	0.0296	0.0298	0.0299
	(0.0579)	(0.0583)	(0.0579)	(0.0578)
Size2	0.0043	0.0042	0.0043	0.0043
	(0.0576)	(0.0580)	(0.0576)	(0.0575)
Size3	0.0032	0.0033	0.0032	0.0033
	(0.0577)	(0.0581)	(0.0577)	(0.0576)
Size4	-0.0013	-0.0007	-0.0003	0.0003
	(0.0595)	(0.0600)	(0.0596)	(0.0594)
Size5	-0.0009	0.0010	0.0003	0.0003
	(0.0612)	(0.0616)	(0.0612)	(0.0611)
Size6	-0.0037	-0.0010	-0.0023	-0.0021
	(0.0619)	(0.0624)	(0.0619)	(0.0618)
Size7	0.0544	0.0549	0.0556	0.0568
	(0.0607)	(0.0612)	(0.0607)	(0.0606)
Year 98	0.1693 **	0.1998 **	0.1713 **	0.1910 **
	(0.0319)	(0.0309)	(0.0320)	(0.0337)
CD	-0.8265 **		-0.8452 **	-1.0547 **
	(0.2709)		(0.2719)	(0.2941)
S		0.1181	0.1684	-1.5303
		(0.1996)	(0.1989)	(0.9413)
CD*S				2.4769
				(1.3417)
Adj.R2	0.1042	0.0911	0.1038	0.1073
Observation	670	670	670	670
F test	1.75	1.78	1.75	1.80

** denotes 99% significance. Standard errors are in parenthesis. CD and S denote the diversification index and the labor share respectively. CD*S is the diversification multiplied by the share.

Chapter 6.
Summary and Conclusions

6.1. Summary

Many economists have suggested theoretical and empirical rationales for corporate diversification across industries. These explanations have focused specifically on the different incentives for diversification and on the effect of diversification on performance. The Korean conglomerates, or *chaebols*, have a number of unique characteristics with respect to their governance structure, their substantial roles in national economic development, their large size, and their special relationship with the government and the banks. This study described and analyzed the Korean *chaebol* diversification process and related performance, based on both theoretical and empirical models. By using *chaebol*-level data and productivity data, the empirical analysis confirmed that *chaebols* diversified across various industries by increasing external debt. Also, it showed that *chaebol* diversification is, generally, negatively correlated with economic performance. These findings imply that *chaebols*, generally, are overdiversified and this overdiversification has a negative impact on economic performance.

In the fourth chapter, a testable theoretical model was developed to identify and investigate incentives for corporate diversification when the government plays a role in allocating capital to industrial firms. As discussed earlier, the Korean government manipulated capital allocation towards strategic sectors and large firms. As a result, these large firms expanded beyond the optimal profit maximizing level. By increasing their debt level through government-furnished policy loans, these firms increased their size and diversified into new areas of business.

Using conglomerate-level data from the 70 largest Korean firms, the empirical analysis revealed that Korean business groups became more diversified when they were externally financed. The relatively cheap external financing, as compared to the market capital price, that was available to *chaebols* also caused an increase in their level of diversification. Furthermore, the analysis revealed that *chaebols* became less diversified in the period after the 1997 financial crisis, when the government reduced financial subsidies to them.

The fifth chapter examined the correlation between the level of *chaebol* diversification and the level and growth of total factor productivity in Korean manufacturing. This analysis suggested that the *chaebols* were highly diversified for the full sample period, even if their diversification pattern varied across time. Before the 1997 crisis, *chaebols* were in the process of becoming more diversified. Subsequently, diversification declined. The regression analysis showed that high levels of *chaebol* diversification were negatively associated with industry productivity and productivity growth. This finding is true for both TFP and labor productivity measures. Alternatively, the share of *chaebols* in an industry did not influence industry performance.

6.2. Limitations of This Study and Implications for Further Studies

This study has some limitations with respect to the collection of available data for *chaebol* firms. The time series data are rather short, as systematic data have been available only since 1986. Thus, even though the *chaebols* emerged in the period 1940-50, and boomed in the period 1960-70, this study can only use observations on *chaebol* firms after 1986. A more detailed examination of the relationship between the *chaebols*

and the Korean government requires data from the earlier industrialization period. This expansion of the period under the study would lead to a clearer identification of the role that government policies have played in the growth of the *chaebols*.

Furthermore, even though the financial crisis of 1997 brought some of the *chaebols* to bankruptcy, it also created new, large business groups. In this study, however, the new groups were excluded due to the unavailability and non-tractability of the data. Future studies could investigate how the *chaebols*' structure changed after the 1997 crisis, and how that crisis influenced *chaebol*/industry performance. These issues could be investigated using *chaebol*-level and industry-level production data from the existing *chaebols* before the crisis, and from the new *chaebols* that emerged after the crisis. Such studies could provide new insights into *chaebol* behavior and into how *chaebol* diversification changed post-crisis, and how this affected the economy generally.

6.3. Conclusions

Using both microeconomic data and industry-level data from Korea, this study provides evidence that industrial firms tend to diversify when government provides incentives to expand production; that is, when government provides finances on an exceptional basis to a limited number of business entities, offering them relatively cheap capital costs in comparison to the market capital price. This process causes the firms to increase their debt beyond the optimal capacity level. The firms use the easy availability of financial resources to overdiversify their business activities into other industries. This study confirms that *chaebol* overdiversification results in inefficiency and poor economic performance. In the case of Korea, *chaebols* accumulated

considerable debts and operated inefficiently; many filed for bankruptcy before and during the 1997 crisis. This study also points to the Korean government's ineffective intervention in financial markets. In effect, the government promoted the misallocation of resources, which were skewed toward large, inefficient business groups. The *chaebols* need to eliminate inefficient business operations in order to improve their performance.

This study has made the following important contributions to diversification literature:

(1) A testable theoretical model that encompasses incentives for corporate diversification, unlike other empirical data oriented studies. Many researchers have attempted to identify motivations for, and implications of, *chaebol* diversification, without a well-formalized framework.

(2) Confirmation of recent research. Corporate diversification, in general, has a negative effect on firms' performance. This study supports this hypothesis.

(3) A timely empirical study of *chaebol* diversification in Korea, at a time when the government is looking to restructure *chaebol* groups in the wake of the financial crisis of 1997.

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