Title
Essays on the Effect of a Financial Crisis on the Productivity of Firms

Author
Kim, Bo Kyung

Publication Date
2013

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA

Los Angeles

Essays on the Effect of a Financial Crisis on the Productivity of Firms

A dissertation submitted in partial satisfaction of the requirements for the degree Doctor of Philosophy in Management

by

Bo Kyung Kim

2013

ABSTRACT OF THE DISSERTATION

Essays on the Effect of a Financial Crisis
on the Productivity of Firms

by

Bo Kyung Kim
Doctor of Philosophy in Management
University of California, Los Angeles, 2013
Professor Marvin B. Lieberman, Chair

This dissertation investigates the effects of a financial crisis on the productivity of firms. It contains four separate studies. The first study conceptually reviews how the productivity of firms changes during a financial crisis. It introduces two conceptual effects of a financial crisis: (a) the effect that cleanses inefficient elements out of the economy; and (b) the effect that provides surviving firms with an opportunity of productivity improvement. This chapter further describes how the financial sector and governments may react during a financial crisis, and thus affect the productivity of the economy. The remainder of the dissertation empirically examines the effect of a financial crisis on the productivity of firms by investigating the 1997 Korean crisis.

The second study analyzes the effect of a financial crisis on the dispersion of productivity. Specifically, it examines whether there is a statistically-significant change in productivity dispersion between the pre- and post-crisis periods. To test whether

the increase in dispersion is significant, the variance decomposition model is applied. Specifically, the measuring of variance decomposition at both the inter- and intra-industry levels allows us to investigate the change in variance within industries while controlling for the change in variance between industries, and vice versa. The results of this chapter empirically confirm that the increase in productivity variation between the pre- and post-crisis periods was statistically significant in the Korean crisis.

The third study investigates the effectiveness of the government-driven restructuring in the corporate sector. Restructuring of the corporate sector has been recognized as a key to recovery from financial crises. However, there is no general consensus in terms of how to best conduct corporate restructuring during a financial crisis. To measure the effectiveness of a government driven corporate restructuring process, the study investigates the "workouts" mandated by the government during the 1997 Korean crisis. Specifically, it draws upon a method of "matching" to compare the firms that actually participated in the workout with the firms that did not go through such a workout, but which were otherwise similar to the participant firms. The study finds no statistical difference in terms of productivity improvement between the participant firms and non-participant firms.

The final study analyzes how business groups can improve their group productivity by restructuring their business portfolio in response to rare opportunities provided by a financial crisis. The overall group level productivity can be improved by four distinct activities of portfolio restructuring: (a) improving productivity of its individual affiliates; (b) acquiring productive businesses; (c) discarding unproductive affiliates; or (d) reallocating resources among affiliates to support the growth of higher performing affiliates. Employing the method of productivity decomposition, this study investigates how each of four activities of portfolio restructuring contributes to the change of group productivity.

The dissertation of Bo Kyung Kim is approved.

Paola Giuliano

Mariko Sakakibara

Jinyong Hahn

Marvin B. Lieberman, Committee Chair

University of California, Los Angeles

2013

To my family.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGEMENTS

I would like to express my deepest gratitude to my advisor, Marvin Lieberman, for his continuous encouragement and constructive guidance throughout my academic journey. I would like to sincerely thank my early mentor, Mariko Sakakibara, for her grateful care and continuous support. I would also like to sincerely thank my dissertation committee members, Paola Giuliano and Jinyong Hahn, for their insightful comments and help in developing my dissertation.

I thank Subramaniam Ramanarayanan, who provided invaluable guidance in my early journey in the program. I thank Professor Steve Lippman for his continuous support. I thank Professors Daniel Ackerberg, Sushil Bikhchandani, Michael Darby, Florian Ederer, William Greene, Timothy Groseclose, Mark Handcock, Hugo Hopenhayn, Jeffrey Lewis, Rosa Matzkin, Sanjog Misra, John Riley, Richard Rumelt, and Jason Snyder, who provided the courses that have developed my research skills.

Although I did not have any cohorts in my department, I was blessed to have been surrounded by many kind and supportive people. I thank Jeongsik Lee and Minha Hwang, who gave me invaluable advice and guidance. I also thank Mitsuru Igami for many discussions from which I greatly benefitted. I am thankful to Young Ju Kim and Ho Kim for their sincere concern for me. I thank the people in my department: James Ostler, Sara Parker, Vanessa Burbano, Dharma Kwon, and Gabriel Natividad. I thank Lydia Heyman for her unforgettable help with the administrative work and procedures throughout the program.

Special thanks go to Yong Hyeon Yang, whom I cannot be thankful enough. He is one of the most good-hearted persons it has been my good fortune to know. I cannot imagine how my life at UCLA would have been without him. I also thank Jinyoung Lee, Jiyeon Seo, Tae Jung Park, So Hyung Park, Scott Barkowski, Chan

Mang, and Allison Shertzer in the Economics department, with whom I took many courses together.

I thank Professor Seong-Joon Limb, without whom this journey would not have even begun. I also thank Professors Choelsoon Park, Dong-Sung Cho, Dong-Kee Rhee, and Sang Wook Park, who helped me build the solid foundation which made my subsequent journey at UCLA possible.

I thank Chris Hudson for our friendship and our conversations about life. I thank MarcAurelio Ranzato for his concern, encouragement, and advice. I also thank Yoon Sung Nam and Taehyun Kim for their encouragement and advice. I thank Moo Hyeon Kim for sharing his industry insights. I thank Choon Ho So for his encouragement, and cannot wait for him to join the academia.

I was blessed with the opportunity to have continued to develop my faith at the University Catholic Church throughout my studies. I thank Fr. Peter, Fr. Paul, Ceci Gray, and Joan Vos for their spiritual guidance. I heartfully thank Irene Wong, Gerard Covento, and Aurelian Philippot, to whom I am deeply indebted for their strengthening of my spiritual life. I thank Amanda Brodell, Kaitlin Collins, and Joby Joseph, with whom I could enhance my faith through our Bible study. I thank Eugene Del Valle, Erica Pinto, Thomas Rehagen, Mary Starks, David Urdaneta, Kurt Anderson, Lewis Dedios, and the other choir members, with whom I could joyfully worship God.

I gratefully thank my respectful father, my lovely mother, and my adorable brother for their support and faith in me. Without them, everything would have been much different. With them, everything becomes meaningful.

Finally, I thank God, for I believe that the journey of my graduate study has been planned and guided by God.

VITA

2002	B.A., Business Administration Chung-Ang University Seoul, Republic of Korea
2004	M.B.A. Seoul National University Seoul, Republic of Korea
2006	M.A., Economics New York University New York, New York
2008-2011	Teaching/Research Assistant UCLA Anderson School of Management Los Angeles, California

1 OVERVIEW OF DISSERTATION

This dissertation investigates the effect of a financial crisis on the productivity of firms. Financial crises have become more frequent, more damaging, and more contagious in the modern economy. Despite the obvious negative impact of crises, claims of some benefits from a financial crisis have been reported in the literature. While crises are disastrous in general, they may contribute to resolving accumulated inefficiency in the economy. For example, crises may purge the economic system of undesirable products, obsolete technologies, incompetent management, and inefficient practices. If this is true, besides negative effects, a crisis may also have some positive effects that contribute to ultimately improving the operation of the economy as a whole. Of the various potential effects of a financial crisis on the economy, this dissertation focuses on their possible effect on the productivity of corporations.

Whenever the effect of a financial crisis on the productivity of the economy is discussed, we should hold in mind that a financial crisis is distinct from other types of crises, such as a natural crisis or an ordinary recession. The main difference is that, during a financial crisis, the malfunction of the financial sector often triggers a simultaneous nationwide recession across almost all industries. Because of the severity of a crisis, the reaction of the government may further affect the way a financial crisis ultimately affects the economy.

Chapter 2 reviews the phenomena which occur during a financial crisis. Specifically, this chapter introduces two (not mutually exclusive) concepts that are useful to understand the dynamics of the effect of a financial crisis on the productivity of the economy. The first of these is the so-called "Cleansing effect" (Caballero and Hammour, 1994). The literature claims that economic crises, including a financial crisis, will "cleanse out" accumulated inefficiency, and eventually contribute to the

long-term productivity growth of the economy. This view is based on the notion of "creative destruction" (Schumpeter 1939, 1942), and is similar to the concept of "natural selection" (e.g. Nishimura, Nakajima, and Kiyota, 2005). The second factor is referred to as the "Pit-stop view" (Aghion and Saint-Paul, 1991), and also provides a useful perspective for understanding the effect of a financial crisis. This view claims that depressed demand during a crisis causes firms to back away from fully committing their production activities, and provides firms the opportunity of utilizing idle resources on productivity-enhancement activities.

Chapter 2 also introduces the 1997 financial crisis in South Korea, which provides useful background information about the events which will be empirically investigated in the subsequent studies. The remaining three chapters empirically investigate the Korean crisis in order to answer the question of how the actual productivity of firms changes during a financial crisis. In addition to the two theoretical views introduced in Chapter 2, there are other factors that may affect the actual outcome of productivity changes during a financial crisis. First, malfunction of the financial sector can affect the overall crisis situation in ways that are very different from other kinds of crises. Secondly, the intervention of the government can further influence how the productivity of firms will be altered during a financial crisis. Based on this important distinction between other types of crises, Chapter 3 empirically investigates how the productivity of Korean firms changed during the 1997 Korean financial crisis. Although the effect of a financial crisis on the economy is expected to be substantial in general, the effects are expected to be different among different industries and firms within an industry.

Accordingly, Chapter 3 focuses on the dispersion (or variation) of the productivity changes during the crisis. Specifically, it investigates whether the dispersion of the industry average productivity widened or narrowed, and whether the productivity

dispersion of firms within an industry became wider or narrower. Chapter 3 draws upon the multi-level random coefficient model to estimate such change. The results of this chapter reveal that the productivity dispersion of firms within industries increased after the crisis, while the dispersion of industry average productivity did not change in a statistically-significant manner.

When financial crises occur, governments usually intervene actively, hoping to prevent the negative effects of the crises. Because the financial sector does not work properly during a financial crisis, market forces alone may not be sufficient to insure a recovery. Even if a recovery does *eventually* occur, if only market forces are relied upon, the full recovery may take a very long time. In addition, subjecting the entire economy to the unmitigated, long-term negative effects of a financial crisis may prove harmful and very expensive even for the most efficient or healthy elements of the economy. The so-called "sullying effect" (Barlevy, 2002) claims that the brutal "cleansing effect" of a crisis also hurts efficient and healthy firms. For instance, during a financial crisis in which the external sources of financing freeze up, new and emerging firms that would have been economically viable in the long-term may also fail and cease operation as a result of their short-term liquidity problems. Therefore, temporary assistance during a crisis for such vulnerable but viable firms will protect these valuable elements of the economy from being destroyed.

One such assistance approach that emerged as one of the most feasible and promising schemes during the Asian crisis of the 1990s is referred to as the "workouts." In a workout program, a government serves as an intermediary to promote debtor firm-creditor bank agreements for corporate debt restructuring. Chapter 4 investigates the effectiveness of the workout program in terms of productivity. This analysis involves the same kind of challenge as that used in studies aimed at identifying a causal effect using observational data. Because, by definition, each specific firm either goes

through a workout program or does not (it cannot simultaneously do both), we need to draw upon the comparison between firms that went through the program (the treatment group) and firms that did not go through such a program (the control group). To derive a causal inference in this analysis, we need to mimic the process of random assignment of participants in formal experiments. That is, we ideally want two comparison groups that, except for the fact one group participated the program and the other did not, otherwise are as close to identical as possible in terms of all the other various factors which might reasonably be thought to affect the final outcome. In order to make the control group be as similar to the treatment group as possible, Chapter 4 utilizes the *genetic matching* method. The genetic matching method automatically searches out the best matches in multi-dimensional covariates, using a genetic algorithm which iteratively checks and improves covariate balance. The results show that the effect of the workout program on the productivity improvement of the participant firms during the Korean crisis is not statistically significant. Chapter 4 concludes that, although the workout program *may* have been helpful in other respects, it was not useful for improving the productivity of firms.

The damaging effect of a financial crisis in the modern economy can arguably be likened to that of the asteroid that led to the extinction of dinosaurs. In history, many financial crises have occurred in developing countries. In such developing countries, there exist corporate organizations that are arguably comparable to dinosaurs. These are business groups. A business group is a group of legally independent firms which are operated under common centralized control, usually under the control of a specific family. In most developing countries, business groups are of great importance in the economy. When the financial crisis occurred in Korea, for example, the top 30 business groups accounted for approximately 40% of total value added of the economy. Due to the importance of business groups in the national economy, it is vitally important

to understand how a financial crisis affects business groups.

Chapter 5 focuses on how business groups can improve their group productivity by restructuring their business portfolio in response to rare opportunities provided by a financial crisis. The productivity of a business group is defined as a weighted average (by sales) of the productivities of its affiliates. The overall group level productivity can be improved by portfolio restructuring activities: (a) improving productivity of its individual affiliates; (b) creating new affiliates through acquisition or spin-off; (c) discarding unproductive affiliates; or (d) reallocating resources among affiliates to support the growth of higher performing affiliates. In these regards, a financial crisis provides excellent opportunities for a business group to re-optimize its affiliate composition by mergers, acquisitions, spin-offs, and closing of affiliates, as well as to rationalize and restructure its individual affiliates. Chapter 5 decomposes the productivity changes of business groups accordingly. The productivity change of a business group is decomposed by: (a) contribution by productivity change in continuing affiliates; (b) contribution by new affiliates (entry effect); (c) contribution by discarding affiliates (exit effect); and (d) resource allocation among continuing affiliates (allocative efficiency).

Chapter 5 finds that sizable top business groups realized substantial improvement of their group productivity, compared to the remaining groups (6th - 30th). The top five Korean business groups effectively improved the average productivity of their affiliates, acquired or created highly productive businesses, and removed low performing affiliates during the 1997 financial crisis. Compared to failing business groups, the surviving groups were the ones that had increased their group productivity even before the crisis, and further achieved significant improvement of productivity through portfolio restructuring during the crisis.

2 THE EFFECT OF A FINANCIAL CRISIS ON PRODUCTIVITY OF FIRMS

> "[L]iquidate labor, liquidate stocks, liquidate farmers, liquidate real estate ... it will purge the rottenness out of the system. High costs of living and high living will come down. People will work harder, live a more moral life. Values will be adjusted, and enterprising people will pick up from less competent people."
>
> *— Andrew W. Mellon, former U.S. Secretary of the Treasury, Advice to President Hoover, following the stock market crash in 1929*

2.1 Introduction

Even before the disastrous impact of the 2007-2009 financial crisis in the U.S. economy had subsided, yet another financial crisis emerged in Greece and was threatening to devastate Europe. Financial crises have become more frequent (Bordo, Eichengreen, Klingebiel, and Martinez-Peria, 2001), and the infallible prevention of them is simply unrealistic (Reinhart and Rogoff, 2009).[1] While there is no universally agreed-upon

[1] Analyzing 120 years of financial history, Bordo et al. (2001) find that the frequency of financial crises has doubled since 1973, and conclude the growing frequency of crises.

definition of a financial crisis, a common view is that "disruptions in financial markets rise to the level of a crisis when the flow of credit to households and businesses is constrained and the real economy of goods and services is adversely affected" (Jickling, 2008). A crisis in the financial sector of any country can disrupt its economy and spread throughout the world. The resulting damage of crises is huge. According to Caprio and Klingebiel (2003), the estimated losses from financial crises during the 1990s were 47% of GDP in China, 55% of GDP in Indonesia, and 28% of GDP in Korea.

Despite the obvious negative impact of crises, a strand of literature on recessions and broad economic crises has claimed that there is actually some "virtue" in these bad times (e.g. Caballero and Hammour, 1994).[2] The essence of this view is that while economic crises are disastrous, they are especially disastrous for the ineffective elements within the economy. Crises purge the economic system of undesirable products, obsolete technologies, incompetent management, and inefficient practices, and therefore, ultimately improve the operation of the economy as a whole. Only the efficient firms can survive during the shortage of resources or suppressed demand, while the inefficient firms are forced out of business. Bresnahan and Raff (1991, 1993) report that, during the Great Depression, plant shutdowns in the American automotive industry were concentrated in smaller, less productive plants, and this phenomenon has been interpreted as a "cleansing" of the productive structure (Caballero and Hammour, 1994).

This so-called "cleansing process" supposedly frees up the resources held by less efficient firms and makes them available to more efficient firms (Davis and Haltiwanger,

[2]In order to be consistent with the diverse existing literature related economic downturns, including recessions, financial crises, oil shocks, etc., this study uses the general term, "economic crisis" to include any such downturn. Specifically, as used in this paper, the term "economic crisis" refers to a broad range of economic downturns: any long-term economic state characterized by high unemployment, low prices, and low levels of trade and investment.

1992). Low demand during a crisis also contributes to the increase in the efficiency of the survivors, because firms transfer their resources from production activities to activities intended to improve productivity (Aghion and Saint-Paul, 1991). In actual financial crises, however, other influences may hinder the cleansing process. A financial crisis often involves the malfunction of the financial sector and the intervention by governments, which may dilute, prevent, or even counteract the cleansing effect. During a financial crisis, banks usually have their own liquidity problems, and may continue allocating resources to loss-generating firms in order to help them survive, because the bankruptcy of such firms can lead to the failure of the banks themselves. Furthermore, government interventions can distort the cleansing effect of the crises. To avoid the possible economic collapse, the government may support firms regardless of their performance. These additional factors such as the malfunction of the financial sector and the interruption by governments request empirical analyses in order to understand the *actually realized* effects of financial crises.

The main purpose of this chapter is to review the effect of a financial crisis on productivity of firms and to describe overall situation during the 1997 financial crisis in South Korea. Section 2.2 reviews on the effect of a financial crisis on productivity, focusing on cleansing effect, malfunction of financial sectors, governmental intervention, and pit-stop view. Section 2.3 describes the 1997 financial crisis in Korea in such context. Section 2.4 concludes.

2.2 Effects of the Financial Crisis

The study of a financial crisis cannot be isolated from the study of a recession. As a result of a pronounced contraction in economic activity and significant strain upon government resources (Reinhart and Rogoff, 2009), a financial crisis usually brings

about a severe recession. As claimed by the literature on recessions, if financial crises provide a "one-shot cure" (Maliranta, 2001) by weeding out the inefficient firms in a short time, the crises accelerate economic growth; efficient firms grow and inefficient firms disappear. This process is reflected in the narrowing of productivity dispersion.

However, the details of what *actually* occurs during a financial crisis may differ from the predictions based on a recession in general. This is primarily because a financial crisis shares the following general patterns.[3] First, the crisis hits the financial sector and leads to a malfunction of financial intermediaries. Secondly, the financial crisis causes a nationwide crisis, with the paralysis of the financial sector negatively impacting all industries simultaneously. This severe negativity increases the possibility of the complete breakdown of the whole economy and often results in government intervention. Finally, a financial crisis erupts in an abrupt and unexpected way, leaving economic agents unprepared. This section analyzes how different factors affect productivity dispersion during a financial crisis.

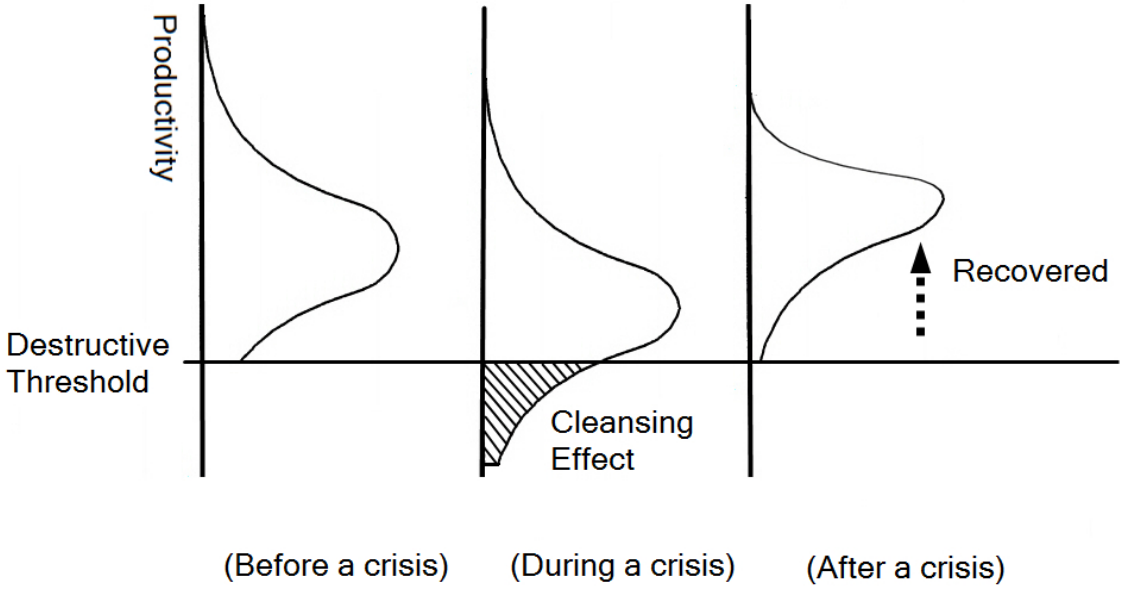
2.2.1 Cleansing effect

Economic crises are often considered to be times of cleansing, a period of healthy relocation and reorganization (e.g., Caballero and Hammour, 1994; Aghion and Saint-Paul, 1991). In other words, outdated, unprofitable, or unproductive firms are eliminated from the economic system during the crises. This idea of a cleansing effect during the crises goes back to the concept of "creative destruction" by Schumpeter (1939, 1942).[4] Schumpeter considers recessions to be "the means to reconstruct each time the economic system on a more efficient plan" (Aghion and Saint-Paul, 1993).

[3]Each crisis is different in terms of the extent to which this general pattern is manifested. Each crisis also has its own distinctive features and peculiarities (Rajan and Sugema, 2000).

[4]Other than the firm level, de Figueiredo and Kyle (2006) study this phenomenon at the product level.

A related concept is the "natural selection mechanism of economic Darwinism" (Van Ewijk, 1997; Nishimura, Nakajima, and Kiyota, 2005). From this perspective, economic crises destroy the weak businesses and free resources for the more productive ones that remain. Figure 1 shows the theoretical cleansing effect of a crisis. During a crisis unproductive firms become more vulnerable to this negative external shocks and get cleansed out once their performances decrease below a certain threshold which Barlevy (2002) calls the "destructive threshold." Once the economy becomes recovered, the remaining productive firms can show higher performances than the pre-crisis period.[5]



Note: Figure modified from Barlevy (2002)

Figure 1: The effect of financial crisis on the distribution of labor productivity

On the empirical side, Caballero and Hammour (1994) interpret as a true cleans-

[5]Barlevy (2002) provides the opposite viewpoint. He claims that the negative effects of a recession can also make severe damages on productivity firms, and leave "scars" on them even after the recession, which is coined by Barlevy as "Sullying effect."

ing effect the findings of Bresnahan and Raff (1991, 1993) that plant-shutdowns in the automobile industry during the Great Depression were concentrated in small, less productive plants.[6] The increased job reallocation during crises (Davis and Haltiwanger, 1992) and the transfer of labor from the less productive firms to the more productive ones have also been interpreted as evidence of cleansing. The cleansing process affects the productivity distribution because the crisis reduces the profitability of all firms, with the least efficient firms becoming unviable (Barlevy, 2002).

2.2.2 Malfunction of financial sector

The disruption of the financial sector is the unique characteristic of a financial crisis, and this differentiates a financial crisis from other types of crises (including other situations that might warrant government intervention). This malfunction of the financial sector can influence the cleansing process. Since the bankruptcy of debtors can lead to the failure of a bank, the banks may continue granting financial support to loss-making firms in order to help them survive. This is what happened during the "Lost Decade" in Japan. The so-called "zombie theory" argues that Japanese banks continued to roll over loans to highly inefficient, debt-ridden companies ("zombies"), thereby slowing the productivity growth of Japan. (e.g., Ahearne and Shinada, 2005, Caballero, Hoshi, and Kashyap, 2008). If this is the case, the cleansing effect described Figure 1 would not be realized.

A related but distinct explanation for the support of less efficient firms during a crisis is provided by Barlevy (2003). He claims that credit market friction during crises results in transferring resources from the more efficient firms to the less efficient ones. His model predicts that business projects which require less financing survive

[6] As Barlevy (2003) points out, Bresnahan and Raff could not find such a cleansing effect in other industries.

regardless of their actual efficiency. Barlevy concludes that a firm with higher productivity borrows more and is more vulnerable to credit constraints. For these reasons, the malfunctioning of the financial sector is expected to support less efficient firms, and thus prevent the productivity disparity from narrowing during a financial crisis.

2.2.3 Pit-stop View

Firms are involved in two types of activities: (a) production activities, and (b) productivity-enhancing activities such as investment and reorganization. A financial crisis can affect firms' performances by affecting firms' balance between these two activities (Aghion and Saint-Paul, 1991). The so-called "Pit-stop view" argues that the opportunity costs of the productivity-improving activities are low during recessions because of low demand (Schuh and Triest, 1998). According to this view, therefore, survivors during recessions devote themselves to activities for improving future productivity. On the contrary, the pit-stop argument may not apply in the case of a severe recession which is often accompanied by a financial crisis. In order to survive, firms may have to cut back their future-oriented activities and concentrate on directly profitable activities (Van Ewijk, 1997).

2.2.4 Entry Effect

A financial crisis can further affect productivity of economy by affecting new entrants during the crisis. In general, the entrants' relative productivity compared to incumbents is predicted differently in literature. On the one hand, traditional vintage models argue that only the new plants or firms embody the best practices at any point in time (Dwyer, 1998). This implies that newly emerging firms will be superior to the outdated incumbents. In this case, the new entrants with higher productivity initially increase the productivity disparity. This will create additional hardship on

the less productive firms and serve to intensify the selection process, narrowing the distribution from the bottom.[7] According to the learning model of Jovanovic (1982), on the other hand, firms initially do not know their capabilities and only learn about it as time goes by. Entrants are not necessarily superior to incumbents. If potential entrants have no *ex ante* beliefs about their productivity, we would observe a wide variation in productivity among entrants, and their contribution to the cleansing process will not be as strong as that predicted by the vintage model.

Secondly, assuming new entrants are more efficient than low-performing incumbents, the entry rate affects the intensity of the cleansing process, and thus the rate at which new efficient entrants replace the outdated inefficient ones. For example, the cleansing effect will be mediated if a crisis reduces the entry rate of new productive firms (Aghion and Saint-Paul, 1993; Caballero and Hammour, 1994). In other words, the decrease in demand during a crisis may reduce the number of new productive entrants, and if so, the inefficient incumbents may be "insulated" (Caballero and Hammour, 1994). In contrast, if the competition among entrants creates "negative congestion externalities," the entry rate does not necessarily plummet during a period of low demand (Aghion and Saint-Paul, 1993). In other words, in order to avoid the severe competition which would be present during an expansion period, at least *some* potential entrants would choose to enter during a recession period.[8] For example, a sizable number of new plants entered the market even during the Great Depression (Caballero and Hammour, 1994).

[7] As an example of an empirical study, Balasubramanian (2007) shows that, in the industries where "learning-by-doing" matters, entrepreneurial entrants have lower productivity than diversifying entrants, and the diversifying entrants have lower productivity than the incumbent.

[8] In a financial crisis, new entrants' access to capital may be difficult due to a paralysis of the financial sector. However, launching new businesses can be promoted by government during a crisis. For example, the Korean government widely supported the new business launches during the crisis to maintain the employment rate. Low competition among new entrants can also bring the diversification of established firms into new business area.

2.3 The 1997 Financial Crisis in South Korea

The empirical analyses of this dissertation focus upon the financial crisis that erupted in South Korea in 1997. Focusing on South Korea provides several advantages. First, the Asian financial crisis in the late 1990s occurred relatively recently, but enough time has passed to provide sufficient data for analysis. Secondly, Korea has the most developed manufacturing sector among the five East Asian crisis countries - Indonesia, Korea, Malaysia, Philippines, and Thailand.[9] Therefore, Korea provides a desirable environment in which to study productivity in the manufacturing sector. Thirdly, Korea is also the most developed country among these countries.[10] Accordingly, examination of the Korean financial crisis provides insights that can be applied to other advanced economies. Fourthly, the Korean crisis represents the most frequently encountered type of a financial crisis — a situation in which banking crises and foreign exchange crises occur together. Fifthly, the Korean financial crisis occurred suddenly and without warning, precluding any endogenous preparation by firms. Korea had been experiencing a lengthy period of rapid growth and gave no hints of an impending crisis until the crisis actually struck.[11] Finally, Korea demonstrated the most rapid recovery among the Asian countries (Koo and Kiser, 2001), and is considered a successful case of overcoming a financial crisis.[12] Therefore, the examination of the

[9]For example, Korea provides 30% of the world's ships, 40% of the DRAM chips, and is ranked fifth in the global automotive/transportation market.
(*from* http://www.fractalfury.com/korea-business-market.htm)

[10]Korea has the fourth largest economy in Asia and the 15th largest in the world (*from* "INSIDE JoongAng Daily". Joongangdaily.joins.com; *recited from en.wikipedia.org*

[11]This argument does not exclude the possibilities that internal sources contribute to the outbreak of the crisis. As Reinhart and Rogoff (2009) emphasize, one common theme in many financial crises is excessive debt accumulation. An excessive debt-to-equity ratio had existed within Korean firms before the crisis, and perhaps this structure of the Korean economy would not have been sustainable. However, unlike other countries, there was no real estate or stock bubble in Korea prior to the crisis (Olivie, 2009) and the direct cause of the outbreak of the Korean crisis was the contamination from the crisis in Thailand together with the low level of dollar reserves by the Korean government.

[12]IMF presented Korea's successful recovery from the crisis as an evidence that fundamental reforms were necessary in Asia (Kalinowski, 2008; Lee, 2003a).

Korean crisis of 1997 provides with an excellent opportunity to study the effect of a financial crisis on the productivity during a successful recovery.

2.4 Conclusion

This chapter reviews fundamental forces during a financial crisis that can affect productivity of firms. First, literature has claimed that a financial crisis may provide "one-shot cure" (Maliranta, 2001) by "cleansing" inefficient elements, and contribute to the long term economic growth. Inefficient firms will disappear during a crisis, and their resources will be freed up toward more efficient firms that can make more value out of such resources. In actual financial crises, however, such "cleansing effect" (Caballero and Hammour, 1994) may not be realized, or cannot achieve its desirable outcome, because some other factors such as governments' intervention and malfunction of financial sector may have effects against it. Pit-stop view (Aghion and Saint-Paul, 1991) further describes dynamics of firms' reaction under a financial crisis. Under low demands during a crisis, firms may reduce their production activities, and more devote themselves to activities that would enhance their productivity.

The understanding of how a financial crisis affects the overall efficiency of the economy becomes more and more important for policy makers, business managers, and academia. No single theory can answer the question of how a financial crisis affects various kinds of phenomena related to productivity of the economy. In other words, how the various and simultaneous forces during a crisis end up affecting productivity of firms is an empirical question. To contribute to this area of subject, each of following chapters analyzes certain phenomenon regarding the productivity of firm in the aftermath of a financial crisis.

3 THE DISPERSION OF LABOR PRODUCTIVITY DURING A FINANCIAL CRISIS: EVIDENCE FROM KOREA

"[O]ur American economy's arteries, our financial system, are clogged, and if we don't act, the patient will surely suffer a heart attack"

— Ben S. Bernanke, U.S. Federal Reserve Chairman,
Appeal to Bailout, following the housing bubble collapse in 2007

3.1 Introduction

Heterogeneity of firms is central to the field of *strategic management* (e.g. Wernerfelt, 1984), and persistent variations in productivity have been a long-standing empirical puzzle in the field of *economics* (Griffith, Haskel, and Neely, 2006).[13] The literature generally interprets the variation in measured productivity as being a reflection of real differences in productivity.[14] The evolutionary literature recognizes the large

[13]In the field of strategic management, some studies focus on the sources of the heterogeneity (e.g. Lippman and Rumelt, 1982), some analyze what affects the degree of heterogeneity (e.g. Balasubramanian and Lieberman, 2010), and others examine how the degree of heterogeneity affects managerial decisions (e.g. Sakakibara, 1997).

[14]Alternatively, Griffith et al. (2006) note that this productivity variation may be illusory. That is, it simply indicates that "we do not measure productivity very well."

heterogeneity across firms regarding their productivity, and seeks to explore the factors behind this heterogeneity within the framework of firm behavior (Nelson, 1981; Bartelsman and Doms, 2000). The resource-based view argues that the persistent differences in productivity are indicative of the fundamental differences in resources and capabilities (Wernerfelt, 1984; Barney, 1986, 1991). A number of empirical studies support persistent variations in productivity of firms, even within very narrowly defined industries (Dwyer, 1998).

The efficiency of the economy is also affected by what may be termed "exogenous shocks." A financial crisis can create extensive exogenous shocks, as Reinhart and Rogoff (2009) note that such financial crises tend to be both unpredictable and damaging. In this regard, it is important to investigate a financial crisis in terms of its effect on productivity of the economy. Despite the obvious negative impact of crises, a strand of literature on recessions and broad economic crises has claimed that there is actually some "virtue" in these bad times (e.g. Caballero and Hammour, 1994).[15]

The literature claims that crises can purge the economic system of undesirable products, obsolete technologies, incompetent management, and inefficient practices, and therefore, ultimately improve the operation of the economy as a whole. Only the efficient firms can survive during the shortage of resources or suppressed demand, while the inefficient firms are forced out of business.This so-called "cleansing process" supposedly frees up the resources held by less efficient firms and makes them available to more efficient firms (Davis and Haltiwanger, 1992). Low demand during a crisis also contributes to the increase in the efficiency of the survivors, because firms transfer their resources from production activities to activities intended to improve

[15]In order to be consistent with the diverse existing literature related economic downturns, including recessions, financial crises, oil shocks, etc., this study uses the general term, "economic crisis" to include any such downturn. Specifically, as used in this paper, the term "economic crisis" refers to a broad range of economic downturns: any long-term economic state characterized by high unemployment, low prices, and low levels of trade and investment.

productivity (Aghion and Saint-Paul, 1991). By affecting different firms in different ways, an economic crisis is likely to increase the productivity disparity, at least initially. Assuming that the hypothetical cleansing process takes place, one can expect economic crises to eventually reduce productivity disparity between firms - effectively creating a more efficient economic system.

In actual financial crises, however, other influences may hinder the cleansing process. A financial crisis often involves the malfunction of the financial sector and the intervention by governments, which may dilute, prevent, or even counteract the cleansing effect. During a financial crisis, banks usually have their own liquidity problems, and may continue allocating resources to loss-generating firms in order to help them survive, because the bankruptcy of such firms can lead to the failure of the banks themselves. Furthermore, government interventions can distort the cleansing effect of the crises. To avoid the possible economic collapse, the government may support firms regardless of their performance.The interruption of the cleansing effect by banks or governments can cause the initially increased level of productivity disparity to be maintained after the crisis.

Because of these factors, a financial crisis can either narrow or widen the productivity disparity between industries or firms. By examining the change in the productivity dispersion, it becomes possible to understand how a financial crisis affects the overall efficiency of the economy. A wide dispersion of productivity suggests an inefficient allocation of resources within the economy. This is because these resources are allocated to some firms that are very far behind the industry leader in terms of performance. Conversely, a narrow dispersion implies a high level of efficiency. This is because it implies most firms that utilize the resources are fairly close to the industry leader in terms of performance.[16] While there are studies on the relations between

[16]Here, the term efficiency is applied locally within a specific national economy. Even if all firms

a financial crisis and productivity growth (e.g., Ohanian, 2001; Meza and Quintin, 2006), there does not seem to have been a study which focuses specifically on the effect of a financial crisis on productivity dispersion. This paper fills this research gap by examining the 1997 financial crisis in South Korea (hereafter referred to as Korea).

The primary objective of this study is to examine whether there is a statistically significant change in productivity dispersion between the pre- and post-crisis periods. This study shows that in Korea, the level of productivity dispersion in the manufacturing sector increased after the 1997 crisis. The increased variation in productivity is traced to increased variation within industries, while the variation between industries did not significantly change after the crisis.

This chapter is organized as follows. Section 3.2 reviews the literature on productivity dispersion. Section 3.3 explores the effects of a financial crisis on the productivity dispersion of firms. Section 3.4 describes the 1997 Korean financial crisis. Section 3.5 describes the data sources. Section 3.6 presents empirical analysis. Finally, section 3.7 discusses and concludes.

3.2 Literature Review

A number of empirical studies support persistent variations in productivity of firms, even within very narrowly defined industries (Dwyer, 1998). Specifically, various factors such as ownership, the quality of the workforce, technology, international exposure, and the regulatory environment are claimed to explain the persistent variation in productivity (see Baily, Hulten, and Campbell (1992) and Bartelsman and Doms (2000) for a thorough discussion). There seem to be common factors that widen

within an industry of a nation display a very narrow dispersion of productivity, the productivity of this same set of firms could collectively be quite far behind (or ahead of) their competitors in another nation or in the world as a whole.

and narrow Labor productivity and TFP at the same time. Bartelsman and Doms (2000) note that "heterogeneity in labor productivity has been found to be accompanied by similar heterogeneity in TFP in the reviewed research where both concepts are measured." In comparing labor productivity between manufacturing and service sectors, Oulton (1998) argues that the low competitive environment is one possible explanation why low productive firms can remain in the market.

Studying the variation of productivity provides important information on the overall efficiency of the economy. A wide dispersion suggests an inefficient allocation of resources, while a narrow dispersion implies a high level of efficiency. Industry characteristics have been explored to explain the trends of productivity dispersion (e.g. internationalization (Melitz, 2003), product substitutability (Syverson,2004a, b), and the introduction of IT (Melitz, 2003; Helpman, 2006).[17]

The efficiency of the economy is also affected by what may be termed "exogenous shocks." A financial crisis can create extensive exogenous shocks, as Reinhart and Rogoff (2009) note that such financial crises tend to be both unpredictable and damaging. In this regard, it is important to investigate a financial crisis in terms of its effect on productivity of the economy. First of all, the impact of a financial crisis on the economy is substantial. Paralysis of the financial sector during a financial crisis can cause a nationwide crisis. Furthermore, complete prevention of financial crises is simply impractical (Reinhart and Rogoff, 2009), and financial crises have become more frequent (Bordo, et al., 2001). Finally, the problem of *international* financial crises is increasing as the economies of all countries have become more interconnected.[18] For example, the 1994 Mexican crisis rapidly spread to Brazil and

[17]See Ito and Lechevalier (2009) for the complete literature list. **?** show that firm performance (value added) is more heterogeneous in the industries with high rate of learning by doing.

[18]Crises are transmitted among countries in many ways: "arbitrage in commodities or securities and movements of money ..., cooperation among monetary authorities, and pure psychology" (Kindleberger and Aliber, 2005).

Argentina, while the 1997 Thailand crisis soon infected several nearby Asian countries. In summary, it seems clear that financial crises have been affecting the national economy significantly and continually.

With the importance of financial crises and their effect on the productivity, a specific sector of literature is devoted to studying how financial crises affect the growth of productivity (e.g. Brandt, Dressler, and Quintin, 2004; Meza and Quintin, 2006; Benjamin and Meza, 2009; Baek, Kim, and Kwon, 2009). Their robust findings illustrate how productivity falls markedly during financial crises. Baek, Kim, and Kwon (2009), for example, found that total factor productivity (TFP) declined during the crisis in Korea, and then bounced back rapidly following the crisis. Indeed, most studies that relate financial crises to productivity focus on the effects of a crisis on the growth of productivity.

Conversely, the effect of a financial crisis on productivity dispersion has received little attention in the literature, although understanding it provides a key insight as to how crises affect the efficiency of an economy. Several studies have examined productivity dispersion during periods of a financial crisis. For example, studies have reported that the dispersion of productivity actually increased during Japan's financial crisis, the so-called "Lost Decade" (1992-2005).[19] To investigate the cause of the slowdown in Japan's TFP growth during the 1990s, Fukao and Kwon (2006) examine the gap between highly productive firms and low productive firms, and find that the gap widened most notably in the industries with highly intense R&D and high internationalization. To examine the determinants of productivity dispersion, Ito and Lechevalier (2009) examine Japan's Lost Decade and find that the introduction of information technology decreased the within-industry labor productivity dispersion

[19]The situation of this period is explained by the so-called "zombie theory," by which Japanese banks continued to roll over loans to highly inefficient, debt-ridden companies (Ahearne and Shinada, 2005).

while internalization and less competitive markets increased the productivity dispersion. While investigating the trend of productivity dispersion *only during* the crisis period, however, these studies did not question whether the financial crisis increased the productivity dispersion compared to the period before the crisis had occurred. In other words, these studies did not attempt to compare the productivity dispersion between the pre- and post-crisis periods, because their interests were not in the effect of financial crisis on productivity dispersion.

In addressing such a gap in the literature, the present study has three distinct contributions. First, this study is the first to focus specifically on the question of how productivity dispersion changes when a financial crisis occurs, as compared to the pre-crisis period. Secondly, this study is the first to apply an econometric method in order to statistically evaluate the significance of such changes in variation. Finally, examining the 1997 financial crisis in Korea complements previous studies based on Japan's crisis because the two crises are very different from each other. The Korean crisis represented the classic type of financial crisis, while the Japanese crisis was purely domestic and did not involve a foreign exchange crisis.[20] The Korean crisis was resolved in a relatively brief period of time (two years), while the Japanese crisis lingered for a longer period (a decade).

3.3 The Effect of a Financial Crisis on the Dispersion of Labor Productivity

The study of a financial crisis cannot be isolated from the study of a recession. As a result of a pronounced contraction in economic activity and significant strain upon government resources (Reinhart and Rogoff, 2009), a financial crisis usually brings

[20]The dominant pattern of a financial crisis is that banking and foreign exchange crises occur at about the same time (Kindleberger and Aliber, 2005).

about a severe recession. As claimed by the literature on recessions, if financial crises provide a "one-shot cure" (Maliranta, 2001) by weeding out the inefficient firms in a short time, the crises accelerate economic growth; efficient firms grow and inefficient firms disappear. This process is reflected in the narrowing of productivity dispersion.

However, the details of what *actually* occurs during a financial crisis may differ from the predictions based on a recession in general. This is primarily because a financial crisis shares the following general patterns.[21] First, the crisis hits the financial sector and leads to a malfunction of financial intermediaries. Secondly, the financial crisis causes a nationwide crisis, with the paralysis of the financial sector negatively impacting all industries simultaneously. This severe negativity increases the possibility of the complete breakdown of the whole economy and often results in government intervention. Finally, a financial crisis erupts in an abrupt and unexpected way, leaving economic agents unprepared. This section reviews how different factors affect productivity dispersion during a financial crisis.

3.3.1 Cleansing Effect

Economic crises are often considered to be times of cleansing, a period of healthy relocation and reorganization (e.g., Caballero and Hammour, 1994; Aghion and Saint-Paul, 1991). In other words, outdated, unprofitable, or unproductive firms are eliminated from the economic system during the crises. This idea of a cleansing effect during the crises goes back to the concept of "creative destruction" by Schumpeter (1939, 1942).[22] Schumpeter considers recessions to be "the means to reconstruct each time the economic system on a more efficient plan" (Aghion and Saint-Paul, 1993).

[21] Each crisis is different in terms of the extent to which this general pattern is manifested. Each crisis also has its own distinctive features and peculiarities (Rajan and Sugema, 2000).

[22] Other than the firm level, de Figueiredo and Kyle (2006) study this phenomenon at the product level.

A related concept is the "natural selection mechanism of economic Darwinism" (Van Ewijk, 1997; Nishimura, Nakajima, and Kiyota, 2005). From this perspective, economic crises destroy the weak businesses and free resources for the more productive ones that remain.

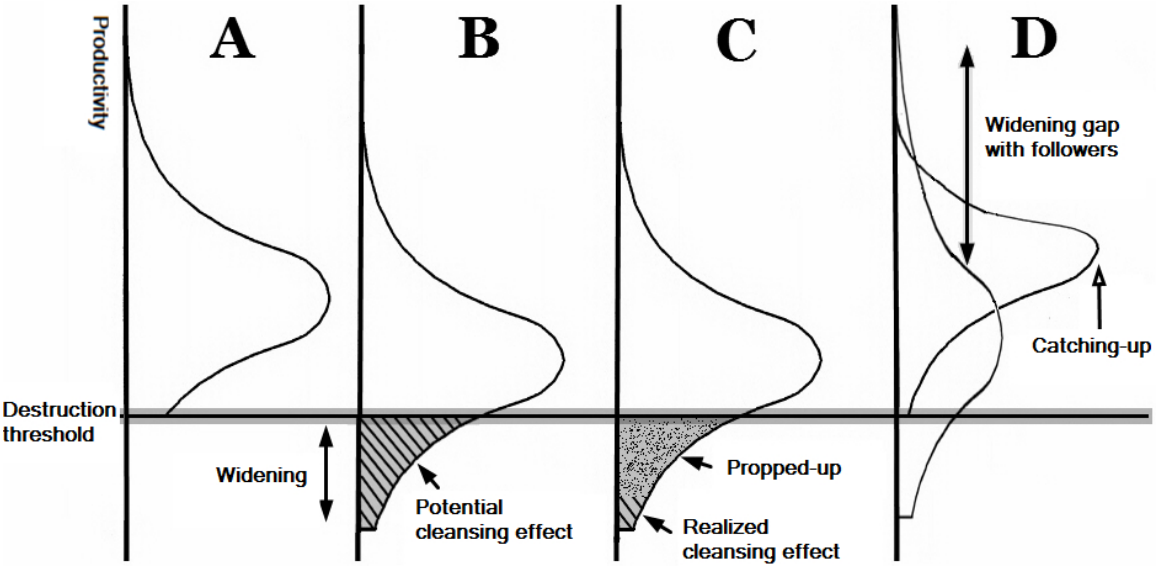
On the empirical side, Caballero and Hammour (1994) interpret as a true cleansing effect the findings of Bresnahan and Raff (1991, 1993) that plant-shutdowns in the automobile industry during the Great Depression were concentrated in small, less productive plants.[23] The increased job reallocation during crises (Davis and Haltiwanger, 1992) and the transfer of labor from the less productive firms to the more productive ones have also been interpreted as evidence of cleansing.

The cleansing process affects the productivity distribution because the crisis reduces the profitability of all firms, with the least efficient firms becoming unviable (Barlevy, 2002). As in Panel B in Figure 2, if the potential cleansing effect is realized, then it will wipe out unproductive firms whose performances are below a certain threshold which Barlevy (2002) calls the "destructive threshold." Therefore, realizing the cleansing effect is expected to narrow the dispersion of productivity.

However, in actual financial crises, the cleansing process may not function the way it has been argued to do during recessions. That is, although the failure of firms increases dramatically during crises, the failing firms are not necessarily the least productive.[24] For example, Nishimura et al. (2005) found that, during the financial crisis in Japan, the productivity of exiting firms was *higher* than that of surviving firms, which is the reverse of the other periods. They interpret this as a breakdown of the natural selection mechanism during a severe recession. Specifically, the financial

[23] As Barlevy (2003) points out, Bresnahan and Raff could not find such a cleansing effect in other industries.

[24] As Barlevy (2002; 2003) notes, the argument that "the cleansing effect drives out inefficient firms" is based largely on intuition or theory, rather than "well-grounded empirical support."



Note: Figure modified from Barlevy (2002)

Figure 2: The effect of financial crisis on the distribution of labor productivity

crisis is known to be harsher on smaller firms (Bernanke, 1983), small and medium-sized borrowers (Reinhart and Rogoff, 2009), and infant plants (Ouyang, 2009).[25] If a financial crisis fails to drive out the least productive firms, it does not necessarily reduce the productivity dispersion.

3.3.2 Malfunction of the Financial Sector and Government Intervention

First, the financial sector itself may interrupt the cleansing process. Since the bankruptcy of debtors can lead to the failure of a bank, the banks may continue granting financial support to loss-making firms in order to help them survive. This is what happened during the "Lost Decade" in Japan. The so-called "zombie theory"

[25]The studies on declining industries also suggest that firm size matters in their survival. In the chemical industry, Lieberman (1989) found that small plants had higher rates of closure, and most exiting firms were small. Using a theoretical model, Ghemawat and Nalebuff (1985) claim the opposite view; the survivability is inversely related to size, and the required scale economies to reverse this relationship is substantial.

argues that Japanese banks continued to roll over loans to highly inefficient, debt-ridden companies ("zombies"), thereby slowing the productivity growth of Japan. (e.g., Ahearne and Shinada, 2005, Caballero, Hoshi, and Kashyap, 2008).

A related but distinct explanation for the support of less efficient firms during a crisis is provided by Barlevy (2003). He claims that credit market friction during crises results in transferring resources from the more efficient firms to the less efficient ones. His model predicts that business projects which require less financing survive regardless of their actual efficiency. Barlevy (2003) concludes that a firm with higher productivity borrows more and is more vulnerable to credit constraints. For these reasons, the malfunctioning of the financial sector is expected to support less efficient firms, and thus prevent the productivity disparity from narrowing during a financial crisis.

Secondly, if governments intervene, they can interrupt the cleansing process. Although governments may intervene in any severe crisis, governments are more likely to intervene (or to do so more aggressively) when the financial sector does not work properly. As Gokhale (2009) notes, a well-functioning financial sector has facilitated the recovery from recessions caused by oil shocks; a well-functioning financial sector "channel[s] funds to more profitable enterprises and curtail[s] credit to economically inefficient ones." In recessions caused by oil shocks, for example, most economists agree that the best approach is to allow market forces to promote the necessary structural change, rather than government-determined resource allocation (Gokhale, 2009).

In the crisis involving the disruption of the financial sector, however, intervention proponents generally claim that the crisis may not be cured by market forces alone (Gokhale, 2009).[26] For instance, the strong reluctance of the government to intervene

[26]The so-called "leave-it-alone liquidationists," on the contrary, still insist that government should

resulted in the Great Depression of the 1930s being much wider, deeper, and more prolonged than it otherwise probably would have been (Kindleberger and Aliber, 2005). Moreover, in terms of severity, financial crises have become increasingly more devastating in their macroeconomic effects compared to natural disasters (Ismail, 2009). According to an Asian Development Bank report, the Asian financial crisis of the 1990s caused more economic damage than the tsunami of 2004. This was because of its prolonged nature, its wider impact in terms of geographical scope and the number of economic sectors involved (Ismail, 2009).

Considering the severity of the impact of the crisis and the absence of well-functioning market forces, governments become more likely to intervene aggressively when confronted with financial crises. The historical record confirms that government intervention has generally followed financial crises. Alex J. Pollock of the American Enterprise Institute notes that "[i]f you would like an empirical law of government behavior, it is that in a panic or threatened financial collapse, governments intervene – every government, every party, every country, every time."[27]

The degree of government intervention is expected to be intense in a financial crisis in the sense that the financial sector does not play its normal and expected role in assisting the economy to recover from the crises. Although the responses of governments may vary in degree from one country to another, when confronted with the possibility of a complete economic collapse, governments often prop up financial and industrial firms regardless of their performance. For example, Hinds

allow the crisis to resolve itself (Kindleberger and Aliber, 2005).

[27] "Government Bailouts: A U.S. Tradition Dating to Hamilton," *Wall Street Journal*, (September, 20, 2008). Kindleberger and Aliber (2005) also note that "there are many examples when the [governments] initially were resolved not to intervene but eventually reluctantly did so." In addition, although the usual governmental measures worked in normal times, such as minor changes in monetary policy, the same measures generally do not work in the case of a crisis that includes a liquidity trap (Roubini and Mihm, 2010). This often leads governments to make other types of direct intervention.

(1988) argues that, during a financial crisis, governments in many developing countries allocate resources to loss-making firms, whose bankruptcy would lead to the failure of the banking system. This government's effort to support poorly-performing firms will interrupt the cleansing process, and prevent it from narrowing the productivity dispersion during a crisis.

3.3.3 Pit-Stop View

Literature claims that a recession can provide the period in which firms can make "pit-stop." (e.g. Aghion and Saint-Paul, 1991). In general, firms are involved in two types of activities: (a) production activities, and (b) productivity-enhancing activities such as investment and reorganization. This so-called "Pit-stop view" emphasizes that the depressed demands during recessions will decrease the opportunity costs of the productivity-improving activities against production activities (Schuh and Triest, 1998). Accordingly, surviving firms during recessions can devote themselves to activities for improving future productivity by utilizing their surplus resources. If this is the case, depressed demands during a financial crisis can affect firms' balance between production activities and productivity enhancing activities, and thus further affect their long-term productivity.

If there are differences in the rate of productivity improvement across firms, those differences will affect productivity dispersion of the economy. The panel D of Figure 2 describes the potential effect of different rate of productivity improvement between higher performing firms and lower performing ones. On the one hand, a recession may provide the low-performing firms with an opportunity to catch up with the high-performing firms.[28] On the other hand, if firms display differences in their ability

[28]As described in panel D of Figure 2, a financial crisis can further influence the variation in productivity of surviving firms.

to enhance their own productivity, the productivity disparity between the highest-performing firms and the lowest-performing ones can increase during a crisis.[29]

On the contrary, the pit-stop argument may not apply in the case of a severe recession which is often accompanied by a financial crisis. In order to survive, firms may have to cut back their future-oriented activities and concentrate on directly profitable activities (Van Ewijk, 1997). In a severe crisis, inefficient firms are likely to cut back their future-oriented activities to survive, while efficient firms can afford to continue such activities (e.g. Intel). This will further widen the productivity dispersion.

3.3.4 Influences on the inter-industry dispersion of productivity

While the effect of a financial crisis on the productivity dispersion has mainly been discussed within the industries, it can be easily extended to the inter-industry productivity dispersion. First, there is cleansing effect at the industry level. Although we do observe that entire firms within an industry become at risk during a financial crisis, the cleansing effect may not be as strong upon a whole industry as on the individual firms. This is because an industry would be extinct if all of its firms were to exit.[30] In addition, governments may have strategic or political reasons to protect particular industries. We observe the bailout is often provided on an industry-selective basis (e.g. only to the automobile industry and the financial sector in the 2007 U.S. crisis).

Secondly, the pit-stop view is also extended at the industry level. If the productivity-enhancing activities take place in the efficient industries, but not in the

[29]Even if all firms have the same ability to improve their productivity at the same rate, the dispersion in the absolute level of productivity can still widen. This is because a higher initial level of productivity contributes to a higher absolute increase at the same rate of growth.

[30]In financial crises, it is less clear what kinds of industries are more at risk. There are other events in which the causes of extinction are clear. Industries with obsolete technology can be terminated by the advent of new technology. In response to oil shocks, energy-intensive industries can be replaced by industries with energy-efficient substitutes.

inefficient industries, the inter-industry dispersion in the productivity would widen during a crisis. If efficient firms in any industry were to improve their productivity but inefficient firms did not, then the productivity dispersion may not change at the inter-industry level. If inefficient industries catch up to the efficient industries, then the productivity dispersion would be narrower during a crisis.

Related to the pit-stop view, resource transfer or technology spillover between industries may affect the inter-industry productivity dispersion. On one hand, inefficient industries may adopt more efficient technologies or practices from the efficient industries. Alternatively, inefficiently-used resources can sometimes be transferred from efficient industries to inefficient industries. Benjamin and Meza (2009) show that during the crisis there was a reallocation of labor from a high productivity sector (manufacturing) to low productivity sectors (agriculture and the public sector).

In summary, various competing factors affect the productivity dispersion during a financial crisis. First, the cleansing effect will reduce the productivity dispersion by weeding the least productive firms (or the industry as a whole) out of the system. Second, the malfunctioning of the financial sector and intervention by the government can neutralize the cleansing process, and thereby prevent the productivity dispersion from narrowing. Third, the productivity dispersion among survivors will converge if the following firms (or industries) catch up with the productive leading firms (or industries), and it will diverge if the leaders widen the gap. Finally, higher relative productivity among entrants and an increased rate of entry are expected to accelerate the cleansing. In analyzing the effect of a financial crisis on productivity dispersion discussed above, the following empirical section investigates the 1997 Korean financial crisis. Specifically, the section limits its focus to the following subjects: (a) whether the dispersion increased during the Korean crisis; (b) whether the dispersion increase was generated inter-industry or intra-industry.

3.4 The 1997 Financial crisis in South Korea[31]

Following the economic policy reforms in the early 1960s, Korea grew rapidly for three and a half decades through the mid 1990s (Krueger and Yoo, 2002). However, the two consecutive years of economic expansion in 1994 and 1995 were followed by the slowdown of the economy in 1996, which ultimately led to the financial crisis in 1997. In preparing to join the OECD in 1995, the Korean government relaxed financial regulations and opened the capital market to foreign investment. The demand boom, combined with the relaxed regulations, stimulated banks and large firms to increase their borrowing from abroad.[32] This over-investment and increased short-term borrowing increased the vulnerability of the economy.

In 1996, a severe economic slowdown was caused by the depreciation of the yen, the stagnation of domestic demand, and the sharp fall in Korea's terms of trade.[33] The Korean stock exchange index fell, highly leveraged conglomerates went into bankruptcy, and financial institutions faced liquidity deficiency.[34] Along with these evident weaknesses of the Korean economy, the speculative attack on the Thai baht revealed the liquidity problems of Korean merchant banks (Koo and Kiser, 2001). On November 21, 1997, in order to avoid default, the Korean government was forced to ask for an emergency loan from the International Monetary Fund (IMF). By the end of 1999, the Korean government paid back the IMF loan ahead of schedule, and officially announced that Korea had overcome the financial crisis.

During the crisis, the severe recession caused Korean firms to cut back future-

[31] See Kruger and Yoo (2002) and Koo and Kiser (2001) for detailed descriptions of the financial crisis in Korea.

[32] Due to demand boom in 1994 and 1995, a number of firms, especially Korean business groups, undertook aggressive investment financed by the external borrowing (Chang, 2003).

[33] The weak yen causes price disadvantage to Korean firms in the international competition with Japanese firms.

[34] These three events are summarized from Yoon (2007).

oriented activities in general. For example, the *training cost per employee* and the *investment in capital equipment* dropped during the crisis. The financial crisis provided firms with excuses for lay-offs under the amended Labor Standard Act in 1998 (Koo and Kiser, 2001). The Korean government pressured the commercial banks to roll over all of the existing debt of small and medium-size firms. The government also directly supported firms at risk. Kim (2004) provides evidence that the government support was primarily dispensed to the firms whose competitiveness was weakening.

3.5 Data and Measurement

3.5.1 Data sources

The main source of data for this study is the KIS-VALUE database created by the Korea Investors Services (KIS). The KIS-VALUE provides company profiles and financial information for Korean firms since the early 1980s. The KIS-VALUE database covers both the listed firms and unlisted firms subject to an external audit.[35] The weakness of the KIS-VALUE database is it includes only information on existing firms.[36] To mitigate this drawback, the KIS-VALUE database is complemented by KIS-LINE database, which is also created by the Korea Investors Service (KIS). KIS-LINE database is expected to contain majority of closed firms subject to external audit. In addition, some of missing data points were complemented by the database compiled by the *Korea Listed Companies Association* (KLCA), which provides financial information on the publicly-listed companies beginning in 1981.[37] All the

[35]In Korea, firms greater than a certain size are subject to external audit. This criterion has been changed several times. For example, under the regulations which took effect in 2009, firms with assets greater than 10 billion won (approximately $10 million) are subject to an external audit in Korea.

[36]The sample in the KIS-VALUE database only includes firms that were in business as of the end of 2009.

[37]KLCA dataset contains financial information during the period for which firms maintain their status as listed firms and audit firms.

databases take accounting data at the end of each year. This study restricts the sample to the manufacturing sector. Since the crisis erupted in 1997, the year 1997 is excluded in our sample period to avoid mixed effect of pre- and post-crisis period. In order to minimize other confounding effects, the sample period focuses on the five years before and after the 1997 crisis.[38]

When a cross-industry database is examined, careful attention to the outliers is required to make sure the results are not driven by the data errors. The most common way to deal with outliers is to exclude extreme observations from the sample. For example, trimming 1% of the observations is conventional in work involving the *Compustat* database (Barlevy, 2003). Studying the dispersion rather than the mean, this study is more sensitive to outliers. Moreover, careless trimming the observations may result in the removal of meaningful variations of the dispersion. Therefore, the sample for analysis was carefully prepared through the following procedure. The sample excluded two extreme values of labor productivity (the maximum and the minimum) in each two-digit industry for each year. Observations of firms whose employees were less than 10 were excluded.[39] Because the dispersion measure is calculated by inter-decile range, this study excluded the industries in which the number of firms was less than 10. Therefore, this study excludes oligopolistic industries.

The variation in the productivity among exiting firms increased during the crisis (1997 and 1998). To avoid attributing the increased dispersion to increases in dispersion caused by the exiting firms, this study excluded observations of exiting firms in the aftermath of the crisis. For instance, if a firm exits after the crisis, it is included in the sample in the pre-crisis period, but excluded in the post-crisis period. This

[38]The sample is restricted to data beginning in 1992, because the business environment radically changed during the late 1980s in Korea. The sample is restricted to events occurring prior to 2002, to avoid the effects of the collapse of the Internet bubble in 2003 and the global recession in 2006.

[39]Specifically, the industries in the sample contain at least ten firms in all sample periods. In a comparable study, Maliranta (2001) excludes the firms with less than 20 employees.

sample correction makes the cleansing effect appear immediately after the crisis even though it may take some time before the cleansing effect actually eliminates inefficient firms.

3.5.2 Productivity measurement

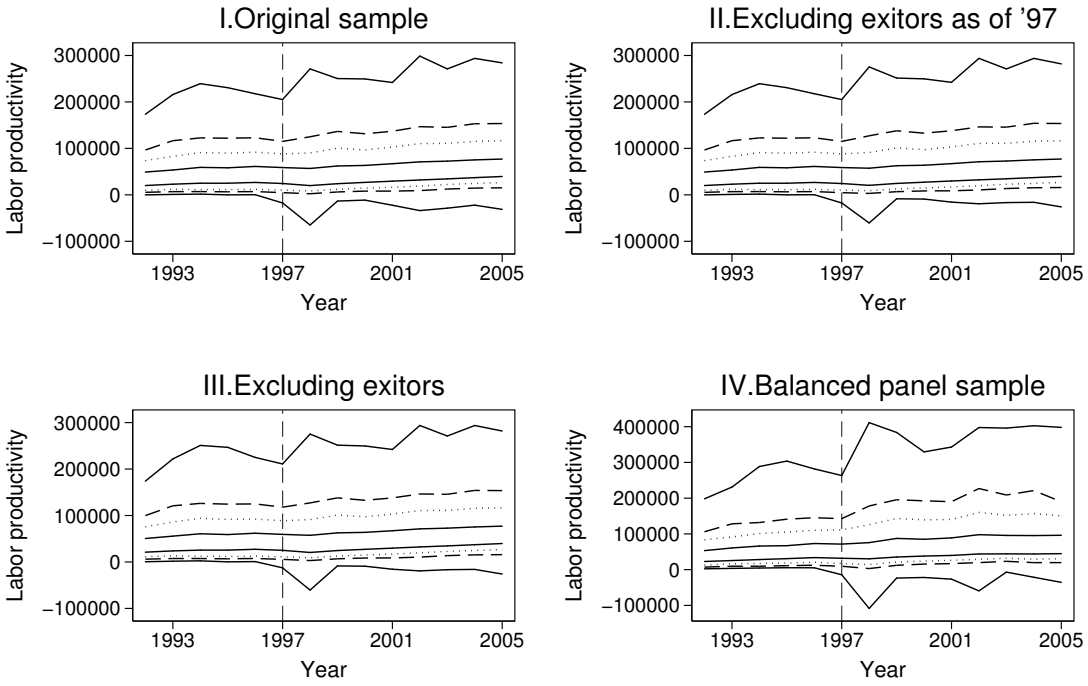
As a productivity measure, this study uses labor productivity. Labor productivity is measured as the Producer Price Index deflated it value-added divided by the number of employees at the end of the fiscal year. Labor productivity is the most common productivity measure, facilitating comparisons with previous studies.[40] While TFP is a more complete measure of productivity, estimating TFP involves additional assumptions (e.g. captital stock and production functional form). The chaotic period of a crisis, however, is not the best periods that satisfy regular assumptions required to estimate standard TFP. In addition, the logarithmic transformation in estimating TFP loses negative observations, which substantially affect dispersion in productivity.[41] Therefore, this study utilizes labor productivity as a main measure for productivity and, refrains from estimating TFP.

3.6 Empirical Analysis

Figure 3 shows the percentiles in the labor productivity of the manufacturing sector. All panels indicate the dispersion in labor productivity increased during the 1997 financial crisis in Korea. In panels II and III, which exclude the closed firms, some

[40] Lieberman and Kang (2008) note that labor productivity is a partial measure. Baily et al. (1996) note that "investment in labor-saving equipment that increases labor productivity may not be successful from TFP point of view."

[41] Estimation of a Cobb-Douglas production function for TFP involves log transformation of value-added, causing loss of observations with negative value. See Ackerberg, Caves, and Frazer (2006) for the discussion about the identification of production functions.



Note: The Y axis is Labor productivity (million won / employee); the X axis is Year. The vertical dashed line indicates the onset of the 1997 Korean financial crisis. Panel I contains the whole sample. In panel II, the closed firms are present before the crisis, but they are excluded after the crisis. Therefore, the cleansing effect is reflected immediately after the crisis. Panel III excludes the closed firms both before and after the crisis. Finally, Panel IV contains only the balanced panel sample. This sample includes firms that do not have missing data from 1992 through 2005. This sample controls for the spurious effect of missing data, as well as the effect of entry and exit of firms. The lines indicate the percentiles of productivity: from the top, 99%, 95%, 75%, 25%, 5%, and 1%.

Figure 3: The Distribution of Productivity of the Manufacturing Sector over Time

firms with negative productivity still remain.[42] To test whether the increase in dispersion is significant, the random effect model is applied. In equation (1), y_{it} denotes the productivity of *firm* i at time t. The productivity is assumed to be described by the effects of time trend (β_0), of pre-crisis period (α_1), and of post-crisis period (α_2).

$$y_{it} = \beta_0 t + \alpha_1 PRE + \alpha_2 POST + \varepsilon_{it} \tag{1}$$

The pre-crisis effect (α_1) is decomposed by the average effect across all firms in the manufacturing sector (β_1) and the firm specific effect (ξ_{1i}). In other words, ξ_{1i} is *firm* i's deviation from the manufacturing sector average (β_1). The post-crisis effect (α_2) is decomposed the same way.

$$\alpha_1 = \beta_1 + \xi_{1i} \tag{2}$$

$$\alpha_2 = \beta_2 + \xi_{2i} \tag{3}$$

By substituting equations (2) and (3) into equation (1), we have the following estimation equation:

$$y_{it} = \beta_0 t + \beta_1 PRE + \beta_2 POST + \xi_{1i} PRE + \xi_{2i} POST + \varepsilon_{it} \tag{4}$$

where y_{it} is labor productivity of *firm* i at time t, t is the time trend, PRE is an indicator variable equal to one in the pre-crisis period (1992-1996) and zero otherwise, and POST is an indicator variable equal to one in the post-crisis period (1998-2002) and zero otherwise.

[42] In this measure, productivity can be negative when the value-added is negative. This means the values of output the firms produce are less than the values of input (capital and labor) the firms utilize.

In words, the productivity of firms is distributed around the manufacturing sector average (β_1). Since ξ_{1i} is a deviation from β_1, $E(\xi_{1i}|\beta_0, \beta_1)$ is equal to *zero*. $V(\xi_{1i}|\beta_0, \beta_1)$ captures the variability among firms. ε_{it} captures the variation over time within a firm. To apply the maximum likelihood method, the model assumes a jointly normal distribution between ξ_{1i} and ξ_{2i}.

$$\begin{pmatrix} \xi_{1ij} \\ \xi_{2ij} \end{pmatrix} \sim N \left(0 \ , \ \begin{bmatrix} \sigma^2_{\xi 1} & \sigma_{\xi 12} \\ \sigma_{\xi 21} & \sigma^2_{\xi 2} \end{bmatrix} \right)$$

The residual, ε_{it} is assumed to be normally distributed with mean 0, and standard deviation, σ_ε. The model estimates seven parameters $\beta_0, \beta_1, \beta_2, \sigma_{\xi_1}, \sigma_{\xi_2}, \sigma_{\xi_{12}}$, and $\sigma\varepsilon$.[43]

The results in 2 show the variation between firms significantly increased in the manufacturing sector after the crisis.[44] In model 1, the coefficient for $PRE, POST$, and t are 298, 231, and 29, respectively, which indicates that the productivity fell during the crisis and returned to its previous level after about three years. The variation (standard deviation) between firms increased from 330 before the crisis to 404 after the crisis.[45] The difference between the variation before and after the crisis is significant at 99% confidence level. (The t-statistic is 23.22 for model 1, 24.75 for model 2).[46] According to these results, the financial crisis did not seem to effectively reduce the productivity dispersion.

[43]The multi level model is estimated by Stata 10.

[44]Model 2 excludes the outlier industry: C192 (Refined Petroleum Products)

[45]I also tried to restrict the sample between the 5th percentile and 95th percentile. With this regression, the industry variation of the post crisis period increased, but was still not statistically different at the 95th percentile.

[46]A positive correlation between PRE and $POST$ (0.829) indicates that the firms with relatively high productivity before the crisis maintained relatively high productivity after the crisis.

Table 2: Random coefficient model - the Manufacturing sector

	(1)		(2)	
Dep. Var.	***Labor productivity***		***Labor productivity (excluding C192)***	
	estimate	***95% C.I.***	***estimate***	***95% C.I.***
Fixed coefficient				
PRE	298.63		295.81	
	(5.69)		(5.39)	
POST	231.51		225.35	
	(7.74)		(7.65)	
t	29.49		29.72	
	(.55)		(.55)	
Random coefficient				
Firm sd(PRE)	330.28	(322.12 , 338.65)	299.83	(291.94 , 307.94)
	(4.21)		(4.08)	
sd(POST)	404.24	(397.43 , 411.17)	391.55	384.88 , 398.34)
	(3.50)		(3.43)	
corr(PRE,POST)	0.829	(0.812 , 0.846)	.830	(0.811 , 0.848)
	(0.008)		(0.009)	
Residual sd(resid.)	364.47	(362.46 , 366.48)	362.52	(360.52 , 364.54)
	(1.02)		(1.02)	
obs.	75,203		74,874	
Sample	Whole sample		Excluding outlier industry	

3.6.1 Variations between industries vs. within industries

The inter- and intra-industry dispersions in performance have been widely studied in determining the relative importance of collective circumstances at the industry level and of unique actions at the firm level (Schmalensee, 1985; Rumelt, 1991; McGahan and Porter, 1997). In those studies, the decomposed variance is assumed to be relatively *constant* over time. By adding a time dimension into the conventional variance component analysis, this present study analyzes how the productivity variation changes over time – in particular we can test to see if there is an increase in variation before and after the crisis. This variance decomposition at both the inter- and intra-industry levels allows us to investigate the change in variance *within* industries while controlling for the change in variance *between* industries, and vice versa.

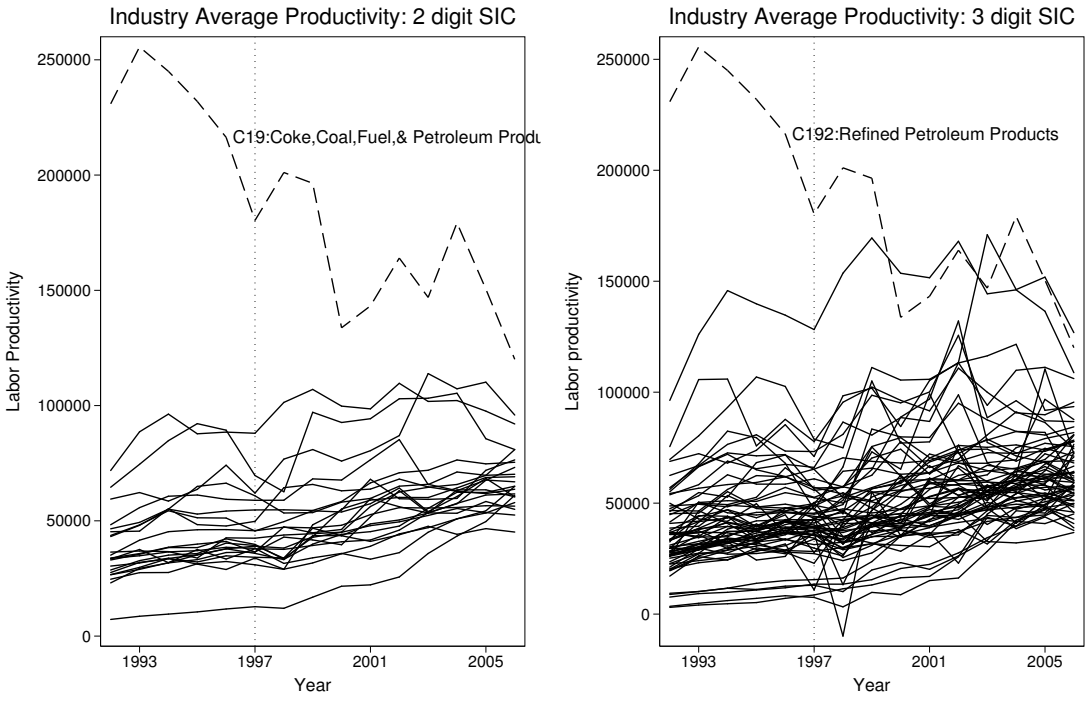


Figure 4: The trend of industry average productivity over Time

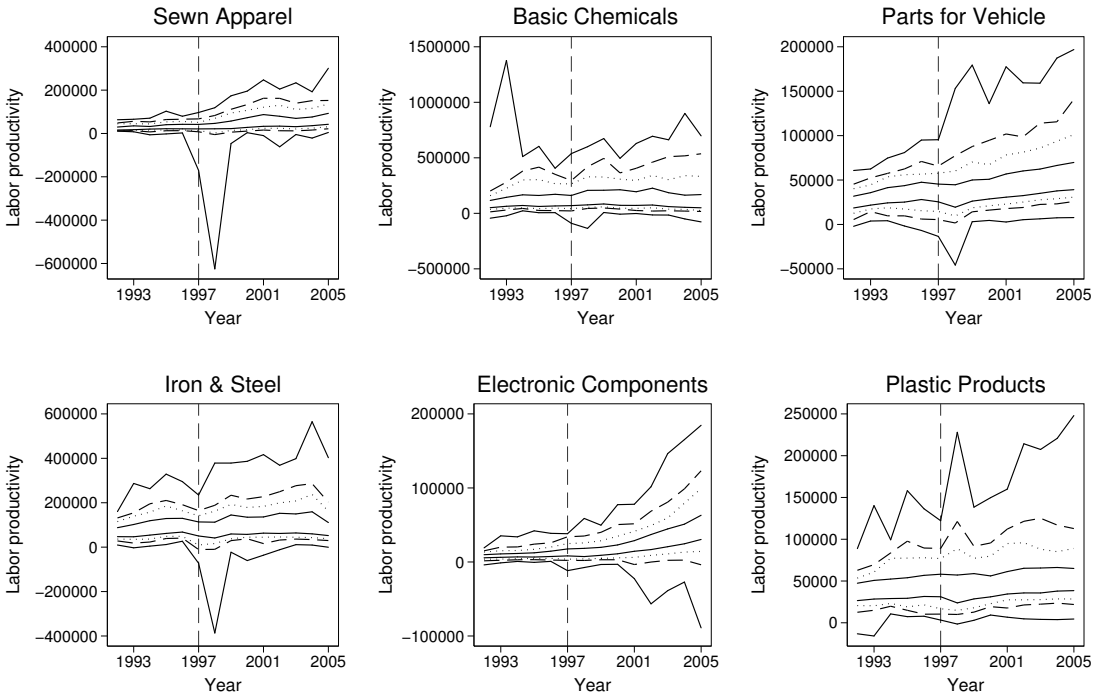


Figure 5: The productivity distribution of firms in each industry

Figure 4 describes industry average productivity. At the top in this figure, there appears an outlier industry (Refined Petroleum Products (C192)). It is unclear whether the estimation of dispersion would be severely affected by the presence of this outlier industry. In the figure, the industries with relatively higher labor productivity before the crisis tended to maintain higher productivity after the crisis. Figure 5 depicts the productivity distribution of firms in six representative industries. The productivity dispersion increased during the crisis, and remained high after the crisis.

To simultaneously examine the inter- and intra-industry variations in productivity, the multi-level random effect model was applied.[47] In addition to the variation at the firm level, the variation at the industry level is considered. In equation (5), y_{ijt} denotes the productivity of firm i in industry j at time t. The productivity variation is assumed to be described by the time trend effect (β_0), the effect of pre-crisis period (α_1), and the effect of post-crisis period (α_2).

$$y_{ijt} = \beta_0 t + \alpha_1 PRE + \alpha_2 POST + \varepsilon_{ijt} \tag{5}$$

The pre-crisis effect (α_1) is decomposed by the average effect across all the industries (β_1) and the industry-specific effect (γ_{1j}). In other words, γ_{1j} is the industry j's deviation from the manufacturing sector average (β_1). The post-crisis effect (α_2) is decomposed the same way.

$$\alpha_1 = \beta_1 + \gamma_{1j} \tag{6}$$

$$\alpha_2 = \beta_2 + \gamma_{2j} \tag{7}$$

[47]The multi-level analysis is widely used for hierarchical data (see Goldstein, 1987). This model has a nested structure and thus variations at all levels are retained (Tsui and Cheng, 1999). For example, class rooms are nested in schools. In our study, firms are nested in industries.

The industry-specific effect in the pre-crisis period (γ_{1j}) is further decomposed by the average effect across all firms within industry j (ζ_{1j}) and the firm specific effect (ξ_{1ij}). ξ_{1ij} is firm i's deviation from industry j's average productivity (ζ_{1j}). The effect in the post-period (γ_{2j}) is decomposed the same way.

$$\gamma_{1j} = \zeta_{1j} + \xi_{1ij} \tag{8}$$

$$\gamma_{2j} = \zeta_{2j} + \xi_{2ij} \tag{9}$$

By substituting (8) and (9) into (6) and (7) following by substituting (6) and (7) into (10), we have the following estimation equation:

$$y_{ijt} = \beta_0 t + \beta_1 PRE + \beta_2 POST + \zeta_{1j} PRE + \zeta_{2j} POST + \xi_{1ij} PRE + \xi_{2ij} POST + \varepsilon_{ijt} \tag{10}$$

where y_{ijt} is labor productivity of firm i in industry j at time t, t is the time trend, PRE is an indicator variable equal to one in the pre-crisis period (1992-1996) and *zero* otherwise, and $POST$ is an indicator variable equal to one in the post-crsis period (1998-2002) and *zero* otherwise.

This multi-level analysis is described in Figure 6, in which the inter-industry variation of productivity became *narrower*, while the intra-industry variation became *wider*.[48] In the pre-crisis period, for example, industry productivity is distributed around the manufacturing sector average (β_1). Since ζ_{1j} is a deviation from β_1, $E(\zeta_{1j}|\beta_0, \beta_1)$ is equal to *zero*. $var(\zeta_{1j}|\beta_0, \beta_1)$ captures the variability among industries. Within industry j, the productivity of firms is distributed around industry j's average productivity. Since ξ_{1ij} is a deviation from the industry average (ζ_{1j}),

[48]This figure should be used for description purpose only, and is not based on the analytical results.

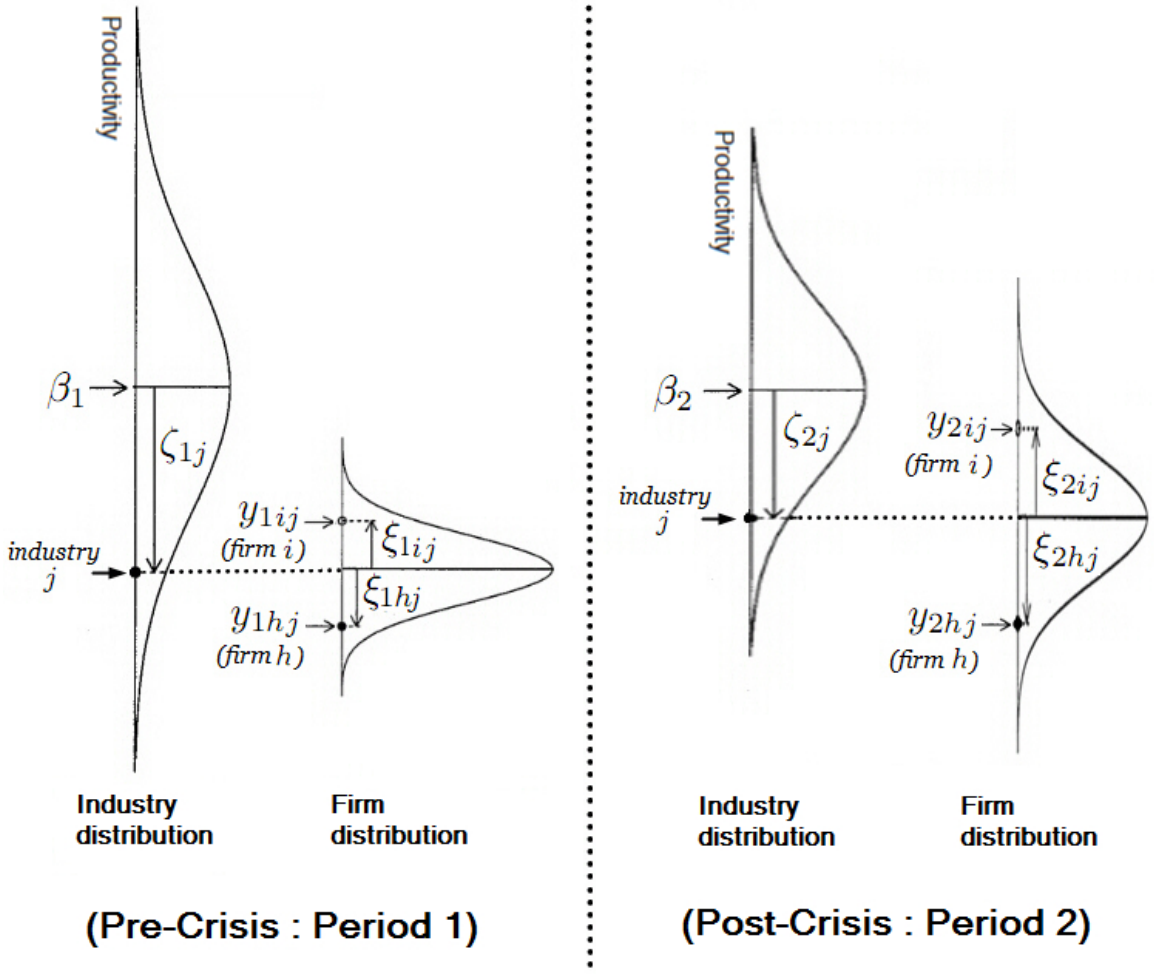


Figure 6: The industry distribution and the firm distribution

$E(\xi_{1ij}|\zeta_{1j}, \beta_0, \beta_1)$ is equal to *zero*. $var(\xi_{1ij}|\zeta_{1j}, \beta_0, \beta_1)$ indicates the variation among the firms within industry j. ε_{ijt} captures the variation over time within a firm. To apply the MLE method, the model assumes jointly normal distributions.

$$\begin{pmatrix} \zeta_{1j} \\ \zeta_{2j} \end{pmatrix} \sim N \left(0 \ , \ \begin{bmatrix} \sigma^2_{\zeta 1} & \sigma_{\zeta 12} \\ \sigma_{\zeta 21} & \sigma^2_{\zeta 2} \end{bmatrix} \right)$$

$$\begin{pmatrix} \xi_{1ij} \\ \xi_{2ij} \end{pmatrix} \sim N \left(0 \ , \ \begin{bmatrix} \sigma^2_{\xi 1} & \sigma_{\xi 12} \\ \sigma_{\xi 21} & \sigma^2_{\xi 2} \end{bmatrix} \right)$$

The residual, ε_{ijt} is assumed to be normally distributed with mean 0, and variation, σ_ε. The model estimates ten parameters $\beta_0, \beta_1, \beta_2, \sigma_{\zeta_1}, \sigma_{\zeta_2}, \sigma_{\zeta_{12}}, \sigma_{\xi_1}, \sigma_{\xi_2}, \sigma_{\xi_{12}}$, and σ_ε.

Table 3 shows the results of this regression. [49] Model 1 is the baseline model that uses labor productivity with the full sample. The *fixed* coefficients, PRE, POST, and t are 315, 246, and 29, respectively, which indicate that productivity decreased but returned to its previous level three years after the crisis. The inter-industry variation (standard deviation) in productivity decreased slightly, from 268.77 to 236.37 after the crisis, this change appears significant (t-statistic of -2.63). This significant change, however, turns out to be driven by the outlier industry (C192) in Figure 4. On the other hand, the intra-industry variation increased substantially, from 245.91 to 360.00 after the crisis, and this change is significant (t-statistic of 23.22). The high correlations in productivity variation between the pre-crisis and post-crisis periods (0.947 at the industry level and 0.793 at the firm level) suggest that industries (firms) with relatively higher productivity before the crisis tend to maintain their relatively

[49] In this model, clustering errors within the conglomerate is not feasible because the conglomerates and the industries do not nest each other. As we see with the previous result of the regression with firm level, we expect the variances of estimates to increase but still to convey consistent results.

Table 3: Multi-level Random coefficient model: the Inter- and Intra-industry variation

	(1)		(2)		(3)	
Dep. Var.	***Labor productivity***		***Labor productivity (excluding C192)***		***Labor productivity ('95,'96,'98,& '99)***	
	estimate	***95% C.I.***	***estimate***	***95% C.I.***	***estimate***	***95% C.I.***
Fixed coefficient						
PRE	315.36	(248.2 , 382.4)	292.39	(245.6 , 339.1)	369.77	(296.6 , 442.869)
	(34.24)		(23.84)		(37.29)	
POST	246.16	(185.8 , 306.4)	225.43	(175.6 , 275.2)	238.99	(149.8 , 328.1)
	(30.77)		(25.42)		(45.50)	
t	29.90	(28.84 , 30.97)	30.15	(29.09 , 31.21)	57.70	(48.02 , 67.38)
	(0.54)		(0.54)		(4.93)	
Random coefficient						
Industry sd(PRE)	268.77	(224.3 , 321.9)	182.56	(152.2 , 218.9)	285.33	(237.9 , 342.1)
	(24.75)		(16.92)		(26.44)	
sd(POST)	236.37	(197.0 , 283.5)	190.22	(158.3 , 228.5)	309.28	(257.9 , 370.9)
	(21.94)		(17.80)		(28.67)	
corr(PRE,POST)	0.947	(0.904 , 0.971)	0.943	(0.892 , 0.970)	0.97	(0.949 , 0.987)
	(0.163)		(0.186)		(0.0088)	
Firm sd(PRE)	245.91	(238.2 , 253.8)	228.44	(220.8 , 236.2)	268.55	(258.3 , 279.1)
	(3.97)		(3.91)		(5.31)	
sd(POST)	360.00	(353.7 , 366.3)	351.89	(345.7 , 358.1)	377.74	(367.3 , 388.4)
	(3.20)		(3.16)		(5.36)	
corr(PRE,POST)	0.793	(0.768 , 0.816)	0.79	(0.761 , 0.812)	0.70	(0.659 , 0.734)
	(0.012)		(0.132)		(0.019)	
Residual sd(res.)	353.76	(351.7 , 355.7)	351.71	(349.7 , 353.6)	309.58	(304.5 , 314.6)
	(1.005)		(1.002)		(2.57)	
obs.	75,203		74,874		16,814	
Sample	whole sample		Excluding outlier industry		Two years before and after the crisis	

higher productivity after the crisis. Model 2 excludes the outlier industry (C192). The inter-industry variation in productivity increased slightly from 182.56 to 190.22 after the crisis, but this difference is not statistically significant (t-statistic of 0.803). The intra-industry variation consistently shows a substantial increase after the crisis, both in statistical significance and in magnitude. Model 3 restricts the sample period to two years before and after the crisis. The results are consistent with Model 2.

3.7 Discussion and Conclusion

Although understanding how a financial crisis affects the efficiency of the economy is an important issue, the previous literature devotes very little attention to the dynamics of productivity dispersion during the crisis. The present study contributes to this literature by analyzing the change in productivity dispersion due to a financial crisis. Specifically, this study is the first to compare the productivity variation between the pre- and post-crisis periods and to apply econometric methods to statistically test the change of the variation. Although financial crises share some general patterns, each crisis is unique. There are variations in the way these general patterns are manifested in each case, and the observation of a wide diversity of phenomena is still consistent with the theory presented in this paper. Therefore, it is useful to investigate what actually happens during each specific crisis. This paper views the 1997 financial crisis in Korea as a specific example, and uses it to investigate the change in productivity dispersion. The results of this study are country-specific, and this paper acknowledges different things can happen in other financial crises in other countries. [50]

The empirical analysis confirms that the increase in productivity variation be-

[50] Indeed, one criticism for applying a general model for a financial crisis is that each crisis is unique with a unique set of features (Kindleberger and Aliber, 2005). In their single country analysis, Meza and Quintin (2006) also note that "while financial crises share many characteristics, a satisfactory quantitative study ... must incorporate country-specific features."

tween the pre- and post-crisis periods is statistically significant. Contrary to the conventional wisdom, this study discovers that financial crises accompanied by the malfunction of the financial sector and government intervention can lead to an *increase* in productivity dispersion between firms. This implies that the contribution of crises to the improvement of efficiency may not be as substantial in financial crises as most prevailing theories have claimed in the context of more general types of economic crises.

Preventing the brutal cleansings by a crisis may bring some short-term, and even long-term, benefits to the economy. Potentially, the Korean government's aggressive intervention caused the rapid recovery from the financial crisis. However, as this study shows, there is also a trade-off. Korea seems to have lost the opportunity to eliminate the inefficient firms. One implication is that governments should be aware of this trade-off when making policy decisions. Governments may choose focus all their efforts on saving the economy first, and may then trim the inefficiency afterwards. In contrast, government may choose to weed out some of inefficient firms at the cost of slowing the recovery.

It is important to acknowledge some of the limitations of this study. First of all, the results of the present paper are based on one single nation, and thus the ability to generalize from the results is rather limited. Secondly, although the dataset of this study combines most of widely available database on Korean firms, such as KIS-VALUE, KIS-LINE, and KLCA databases, this sample still can omit some of closed firms. Developing more comprehensive database, if possible, will help to fully investigate the cleansing effect during crises. Finally, this study is limited to describing how productivity dispersion changed during the financial crisis in Korea, rather than delving into the causal effects of such increased dispersion of productivity.[51] Care-

[51]There are various factors that may affect productivity during a crisis. In the hypothetical coun-

ful future research will identify more rigorously the effect of a financial crisis on the productivity dispersion.

The present study focused its analyses on a narrow subject and leaves more to be investigated. I hope the limited scope of this study will provide an impetus for future studies of greater depth and specificity.

terfactual case of the absence of the 1997 financial crisis, for example, the productivity dispersion *might* have increased the same or even more than what was actually observed in Korea. In other words, this study does not attempt to infer any causal effect by comparing the realized phenomenon with appropriate counterfactual cases, or to investigate the causal factors by using regression analyses. See Ito and Lechevalier (2009) for such a regression analysis.

4 CLEANSE OR PROP UP?: EVIDENCE FROM THE RESTRUCTURING PROGRAM DURING THE KOREAN CRISIS

> "The whole of government needs to contribute to the shared goal of restructuring the British economy. But that means taking on the myth that the Treasury either knows best or can run it all. It just doesn't."
>
> — *David Miliband, Former Secretary of State for Foreign and Commonwealth Affairs*

4.1 Introduction

In recent decades, financial crises have become more frequent (Bordo, et al., 2001), and it is simply unrealistic to think it will be possible to completely prevent them in the future (Reinhart and Rogoff, 2009).[52] Many of financial crises in various countries in the past decades entailed large-scale corporate sector distress, and corporate restructuring was recognized as a key to the recovery (Claessens, 2005). Failure to

[52] Analyzing 120 years of financial history, Bordo, Eichengreen, Klingebiel, and Marinez-Peria (2001) find that the frequency of financial crises has doubled since 1973, and conclude the frequency of crises is increasing.

resolve such distress through appropriate restructuring can threaten the long-term competitiveness of the corporate sector (Mako, 2002). If the inefficient firms are not forced out of the economy, the resources within the economy will continue to be utilized inefficiently. As a result, the presence of inefficient firms in the economy will slow down economic growth and threaten the economy's long-term stability. Accordingly, corporate restructuring has been considered "essential to economic recovery, the long-term viability of corporations, and a lower risk of (subsequent) financial crises" (Claessens, 2005).

However, in terms of how to best conduct corporate restructuring during a financial crisis, there is no general consensus. There is much controversy over such issues as what the role of governments should be. Should governments just observe and allow the crisis to selectively remove inefficient firms out of the economy, or should they actively intervene in such selection processes? The so-called "leave-it-alone liquidationists" insist that government should allow a crisis to resolve itself (Kindleberger and Aliber, 2005), and just allow the market mechanisms to do their work.

In this vein, much literature has claimed that economic crises can provide a "one-shot cure" (Maliranta, 2001) for the accumulated inefficiency of the economy by weeding out the inefficient firms, and can thus accelerate economic growth. This so-called "cleansing effect" (Caballero and Hammour, 1994) supposedly frees up the resources held by less efficient firms and makes them available to more efficient firms (Davis and Haltiwanger, 1992). In other words, a financial crisis provides an opportunity which causes efficient firms to grow and inefficient firms to disappear.

On the other hand, it has also been claimed this brutal "cleansing effect" also hurts efficient and healthy firms as well if they are not protected during a crisis. This has been referred to as the so-called "sullying effect" (Barlevy, 2002). A financial crisis usually brings about disastrous macroeconomic circumstances beyond the control of

any individual firm, which can cause financial distress to all firms, regardless of what future potential strengths, efficiency, or long-term insolvency they may possess. In this situation, a cleansing effect may select out firms based merely on their short-term financial distress, rather than their long-term prospects.[53] For example, in a financial crisis in which the external sources of financing freeze up, firms that fail to continue their operation as a result of their short-term liquidity problems may have had the capacity to achieve the long-term prosperity — *if* they could have received the necessary assistance to survive the crisis. Furthermore, intervention proponents generally claim that a crisis may not be cured by market forces alone, especially during a financial crisis in which the financial sector does not work properly (Gokhale, 2009).

In reality, when confronted with the possibility of a complete economic collapse, governments often have no choice but to intervene in the restructuring processes of financial and industrial firms.[54] Especially during a systemic crisis which forces substantial numbers of firms to *simultaneously* undergo financial distress, general options such as composition, reorganization, and liquidation are not viable options, and unnecessary liquidation entails a welfare cost (Meyerman, 2000). In this situation, an out-of-court, voluntary debt-restructuring process can be "the only alternative" (Mako, 2002). This so-called "workout" or "London Approach" is based on the intermediary role of the UK central bank between creditor banks and debtor firms in financial distress when pursuing corporate debt restructuring (Kent, 1997). The London approach is considered "less time-consuming, less costly, and more rapid in facilitating debtor-creditor agreements for possible turnaround," compared to court receivership or composition (Lee, 2011). For example, during the Asian crisis of

[53]Foster, Haltiwanger, and Syverson (2008) analyzes whether firm turnovers are determined by productivity or profitability.

[54]Hinds (1988) further argues that, during a financial crisis, governments in many developing countries allocate resources to loss-making firms, whose bankruptcy would lead to the failure of the banking system.

the 1990s, the "London approach" (or "workouts") was subsequently adopted as a standard role model by countries such as Indonesia, Malaysia, South Korea, and Thailand (Kang and Han, 2001).

Because such "workouts" are the most feasible and possible restructuring schemes during a financial crisis, evaluation of this approach is of great practical importance. Such an evaluation can provide important insights on the future government policy during a crisis. If the inefficient firms propped up during a crisis really do convert themselves into efficient firms, this implies governments should aggressively interrupt the cleansing effect of a crisis and try to actively guide the crisis to cleanse only the inefficient parts of a firm, and thus prevent the crisis from destroying the entire firm. Otherwise, government actions may turn out to merely be measures which prevent or postpone the bankruptcy. Such results can be interpreted as the "waste of a crisis," in the sense that the economy will fail to achieve the potential efficiency improvement that a crisis otherwise would have forced.

Regarding the importance of evaluating the "workout" restructuring program during the crisis, a series of studies have attempted to investigate the performance change of the firms that went through workout programs (*hereafter referred to as* workout firms). Kang and Han (2001) and Park, Kim, and Shin (2011) compared the same workout firms before and after the crisis. These studies ask good questions, but unfortunately, this prior research is rather limited in its ability to evaluate the effectiveness of workout programs. This is because they were "before and after" studies only, and did not include any appropriate control groups for comparison. Since these studies did not compare beneficiaries with non-beneficiaries that went through the same period of economic crisis, when they compared the performance of the firms before and after the program, it is unclear whether the reported changes should be attributed to the program itself or merely to other macroeconomic changes. To reveal

the effect of the workout program, therefore, we need to find an appropriate control group with which to compare these workout firms. Oh (2006) compared the workout firms with other firms which went through composition or reorganization. This is a better approach than using no control group at all, but the firms that went through composition or reorganization were, on average, considered to be quite different from workout firms. Such firms that went through composition or reorganization were in considerably worse condition to begin with relative to workout firms, and therefore probably should not be considered as an appropriate control group.

Therefore, prior studies, which fail to select an appropriate control group for comparison, suffer from so-called selection bias in non-random assignment. When the assignment of groups is non-random, two groups represent different populations. Analyses without correcting this non-random assignment can lead to biased estimates (Basu et al., 2007, 2008; Jones, 2007; Sekhon and Grieve, 2012). In other words, the characteristics of workout firms and those of the control groups *must* be as similar as possible if we are to attribute the difference between the two groups to the workout program (Gilligan and Sergenti, 2008). The present study revisits the workout programs implemented during the 1997 Korean crisis in order to evaluate the effectiveness of these programs on the performance outcomes of the beneficiaries. Specifically, this paper draws upon a method of "matching" to make the distributions of characteristics of the workout firms and control groups as similar as possible.

The paper is organized as follows: Section 4.2 introduces the concept of workouts: the so called London Approach and the Korea's workout program during 1997 financial crisis. Section 4.3 reviews the literature on the evaluation of the workout program. Section 4.4 describes the empirical strategy: a matching method. Section 4.5 describes data source. Section 4.6 presents empirical analyses and results. Finally, section 4.7 discusses and concludes.

4.2 Workout Programs an Overview

4.2.1 Workouts (London Approach)

A systemic financial crisis creates the need for a large scale corporate restructuring (Stone, 2000). In normal times, financially distressed firms are faced with two options: to either file for bankruptcy or to renegotiate privately with their creditors.[55] However, during a systemic crisis, in which hundreds or thousands of firms simultaneously experience severe financial distress, a bankruptcy process that involves composition, reorganization, or liquidation is not a viable option (Meyerman, 2000).[56] Successful corporate restructuring on a large scale in the aftermath of a financial crisis requires that governments take a leading role (Stone, 2000).

For example, unnecessary liquidation of distressed firms entails a welfare cost to the economy, especially when their distress was caused by macroeconomic circumstances beyond the control of individual firms (Meyerman, 2000). In a financial crisis in which the external sources of financing freeze up, firms that fail to continue their operation as a result of short-term liquidity problems may nevertheless still have the capacity to survive the crisis and achieve the long-term prosperity – if they could receive the necessary assistance. In this situation, an out-of-court, voluntary debt-restructuring process (termed "workout") is an option that is preferred to potentially more costly and time-consuming statutory proceedings (Mako, 2005). That is, workouts can offer higher expected payback than the court-related alternatives (Kent, 1997).[57]

[55] When firms go bankrupt, they usually go through one of three options, such as composition, reorganization, and liquidation. In composition, creditors agree to reschedule payment of debts. In reorganization, creditors and stockholders propose and execute a plan to normalize a bankrupt firm. In liquidation, creditors sell all the assets of a debtor firm (Park, 2005).

[56] See Gilson, John, and Lang (1990) for a discussion of the incentives of financially distressed firms to choose between private renegotiation and filing bankruptcy in normal times.

[57] In addition, workouts become the only option in the situation in which there are hundreds or thousands of simultaneous cases of corporate distress, which overwhelm "local courts, administrators,

A workout is based upon the corporate reorganization approach by used by UK central bank, the so-called "London approach." The term "workout" means "a non-statutory agreement to extend financial support to a company at risk, usually arranged by a company's main banks" (Kent, 1997). A workout seeks to avoid unnecessary damage and to implement solutions that benefit all parties involved, in which banks and other parties still act in their own self-interest (Meyerman, 2000). Therefore, this approach works when the long-term payback prospect from the firms at risk is greater than other court-involved alternatives for creditors and stockholders (Kent, 1997).

The successful application of the London Approach preserves "value for creditors and shareholders, saves jobs, and safeguards productive capacity" (Meyerman, 2000). Indeed, the London Approach has been widely applied and has frequently been successful (Mako, 2005). Considered "less time-consuming, less costly, and more rapid in facilitating debtor-creditor agreements for possible turnaround," compared to court receivership or composition (Lee, 2011), the London Approach was therefore adopted as a standard role model by countries which went through the 1997 Asian crisis, such as Indonesia, Malaysia, South Korea, and Thailand. While there are minor differences and variations in the way this method is implemented in each country, in all cases the approach shares two central common themes: voluntary agreement among stakeholders and arbitration by government in case of failure of agreement (Kang and Han, 2001).[58]

and other insolvency professionals" (Mako, 2005).

[58]In each country, a workout scheme was adapted to meet local conditions; "[t]he relationship between business and government, the nature of corporate debt, the extent to which debt was denominated in foreign currency, how much debt was held domestically" (Meyerman, 2000). Compared to the original London approach, the workout program in Korea was "more intrusive [...] in that the supervisory authorities played a decisive role in setting the direction of workout programs for individual firms" (Park, 2003).

4.2.2 The Workout Program in South Korea

Traditionally, in Korea, the government had been deeply involved in the decision of firms to exit from the economy. Prior to the 1997 financial crisis, Korea maintained the practice of continuing financial support of insolvent large firms without any fundamental prescription at government's approval or suggestion (Oh, 2006).[59] However, during the Asian financial crisis of 1997, the IMF (the International Monetary Fund) and the World Bank forced the Korean government to abolish such practices, and further requested a large scale restructuring of both the financial and the corporate sector. In the corporate sector, the Korean government adopted a very different approach when dealing with the top five business groups (chaebols) than it used with all other firms. The five largest business groups were allowed to execute restructuring largely on their own, with little oversight or external regulation The government merely encouraged these business groups to focus on their core businesses by introducing the business swaps with each other: so-called "Big Deals."[60] To restructure the 6th through 64th largest chaebols and other independent firms which were in financial distress, the government introduced the "workout" program (officially called the "corporate rehabilitation program") based on the London Approach (Park, 2003).[61]

In essence, the workout program was designed to help firms which suffer a temporary liquidity problem but otherwise have promising long-term business prospects. Large creditor banks evaluated their debtor firms, and selected financially-distressed firms whose value if permitted to continue in operation was estimated to be greater

[59]Even after the financial crisis, the Korean government tried to save the large bankrupt firms by allowing them to borrowing funds from banks even after bankruptcy.

[60]See Cherry (2005) and Lee (2004a) for description of "Big Deals." The then second largest business group, Daewoo lost its capacity to revive, and thus turned to workout program. See Lee (2003b) for a discussion of the restructuring of Daewoo.

[61]Creditor banks can swap up to 40 percent of debts owed by the firms for equity (*The Economist*, Nov 12th 1998).

than their value if liquidated. If a firm was accepted into the program, creditors could not redeem their loans to that firm for the duration of the program, the current managers would continue to operate the business, and necessary financing supports would be provided. The participant firms further received various other valuable benefits that would not have been provided under reorganization (Oh, 2006). For example, the workout program included "swaps of debt for equity or for convertible bonds, adjustment of interest and principal repayments, debt payment guarantees, new credits, capital infusion by shareholders, and asset sales" (Park, 2003).

4.2.3 The Procedure of Workout Programs in Korea [62]

This paragraph briefly summarizes Lee (2011) in order to describe the procedure of workout programs in Korea. There were 64 large firms belonging to chaebols proposed financial soundness improvement plans by the end of April 1998. The corporate distress evaluation committee of each creditor bank evaluated the viability for the turnaround of debtor firms by the end of May of that same year. The Corporate Restructuring Coordination Committee (CRCC) provided workout guidelines, and, by July 15, each of the eight major creditor banks had selected at least two business groups and ten large independent firms with no affiliation for workout programs. In July 1998, the Corporate Restructuring Agreement (CRA) contractually bound 210 local financial institutions, and launched the workout program for financial distressed but potentially viable firms (Mako, 2002). Fifty five firms were judged to be non-viable, and therefore forced to exit on June 18.

Among 104 firms that applied for the program, 83 firms were initially accepted into the program. The execution of a participant's plan was then reviewed every six months by creditor banks. There were four potential outcomes for each firm

[62]The first paragraph of this section draws mostly upon Lee (2011).

in the program. If firms successfully improve their performance and meet all the requirements, they would graduate from the program. If firms meet the requirements but there is possibility that the non-agreed creditors will redeem their loans right away, the firms go through "self-execution" rather than graduation. If an evaluation determines the possibility of a firm being normalized is low, the program for such firms will be terminated, and such firms are then required to seek other options such as bankruptcy. Otherwise, the firms continue the program. Among 83 firms, 58 firms were successfully restructured and 18 firms failed in the process.

4.3 Literature Review

Regarding the variation in execution of corporate restructuring, Haley (2000) provides an overview of such differences among the countries which underwent the 1990's Asian crisis: Indonesia, Korea, Malaysia, the Philippines, and Thailand. Dado and Klingebiel (2002) provides a case study approach to analyze the performance in resolving non-performing assets in seven financial crises. They find that only Chile, Norway, and Poland successfully restructured their corporate sectors, while Argentina, Thailand, Hungary, and Japan did not show significant improvement. Dado and Klingebiel conclude that various prerequisites for successful workouts are (a) adequately-capitalized banks; (b) proper incentives for banks and borrowers; and (c) limited or no ownership links between banks and corporations.

To identify the effect of workouts on performances of firms, a handful of quantitative studies have been conducted. Kang and Han (2001) analyzed the workout program in terms of improvement in credit risk. They apply the bankruptcy prediction model to estimate credit risk, and employed a discriminant analysis to explore factors that help to reduce credit risk. They report that one third of workout firms

reduced their credit risk, and conclude that the workout program was successful in terms of reduction of insolvency risk.

Oh (2006) compared the operating income of workout firms with the firms that went through composition or reorganization. Using methods of "ANOVA" and "Tukey," Oh finds that the workout firms display a lower rate of improvement of operating income than the reorganized firms. Compared to reorganized firms, workout firms showed higher operating income at the beginning of the program but display lower operating income after the program had ended. However, in terms of insolvency risk, Oh reports the workout firms showed lower rate of delisting out of the stock market, which is consistent with Kang and Han (2001). Oh concludes that the workout program is not an efficient program in terms of improving profitability. He argues that this result is consistent with his earlier conjecture that the main purpose of the workout program is to prevent bankruptcy, while the purpose of composition or reorganization is to actually revitalize the bankrupt firms.

Park, Kim, and Shin (2011) compare the performance of workout firms before and after the workout program. They report that the outcomes such as *return on assets, return on net sales*, and *operational cash flows* of the workout firms improved after their participation in the workout program. Therefore they conclude that the workout program had positive effects on the profitability and cash flows of the participant firms.

Although the previous studies provide valuable information about the performance of the workout program, they also have some limitations. First of all, some of them did not examine a sufficiently large interval of time. For example, Kang and Hahn acknowledged that because not enough time had passed to permit an analysis of financial performance, they limited the measure of their study to credit risk. Secondly, the baselines used to compare the outcomes of workout programs were not appropri-

ate, and cannot be used to evaluate the true causal effect of the workout program. In evaluating the effectiveness of the workout program, Kang and Han (2001) and Park et al. (2011) focused only on the workout participants, comparing the performance of these firms *before* the workout with those *after* the workout. However, this "reflexive method" has been criticized as being a "counterfeit counterfactual" (Khandker et al., 2010).

Oh (2006) compared the workout participants with the firms that took advantage of other options, such as composition or reorganization. However, the selection of which firms were included in workout programs and which were forced to choose other options was not done by random assignment. The firms selected for inclusion in the workout programs were only those deemed by the selection committees to be potentially salvageable, while those not selected for inclusion were not deemed salvageable, and therefore, (presumably), the members of the second group were probably in considerably worse financial condition than those in the first group. It would therefore be quite inaccurate to assume the only difference between the two groups of troubled firms was whether they went through a workout program or not. When some of different characteristics between the groups could influence performance outcomes, comparing these groups without controlling for the distribution of such characteristics between the groups could lead to systematic bias and very distorted conclusions about the effectiveness of the workout programs.

This present paper investigates the effectiveness of the workout program in Korea by utilizing a more appropriate method to construct more meaningful control groups. It seeks to determine whether the participants in the workout programs outperformed or underperformed relative to non-participants whose patterns of characteristics are similar to the participants. Specifically, this study focuses on productivity improvement as a main performance measure to evaluate the workout program.

4.4 Empirical Methods: a Matching Method

4.4.1 Causal Modeling Using Observational Data[63]

The effect of the workout program would be accurately measured if we observe the potential outcomes on both cases of when firms would participate in and when firms would not participate in the program. Expressed by the terms used in the literature of the *causal analysis*, the workout program is the treatment; the firms that participated in a workout program are the treatment group, while the firms that did not go through the program are the potential control group. For $Firm\ i$, the potential outcome Y_i is realized either as Y_i^1 if $Firm\ i$ would participate the program, or as Y_i^0 if $Firm\ i$ would not participate the program. The effect of the program (the treatment effect) for $Firm\ i$ (τ_i) can be measured by differencing those two possible outcomes.

$$\tau_i = Y_i^1 - Y_i^0 \tag{11}$$

This treatment effect of a specific individual firm ($Firm\ i$) cannot be measured because we cannot observe simultaneously the two possible outcomes (Y_i^1 and Y_i^0) (Holland, 1986). Once we have a group of firms (multiple observations), we can infer the treatment effect on the group of firms. Identifying the treatment effect on such a group of firms requires additional assumptions. First, the exchangeability assumption ensures that the two possible outcomes of each status would not change regardless of realization of the status.

$$E(Y_i^1|T_i = 1) = E(Y_i^1|T_i = 0), E(Y_i^0|T_i = 1) = E(Y_i^0|T_i = 0) \tag{12}$$

[63]For general inference, this section uses terms and expressions drawn from causal modeling literature. First half of this section draws heavily upon Gilligan and Sergenti (2008), Mayer(2011), Ramsahai, Grieve, and Sekhon (2011), and Rosenbaum (2010).

Suppose that we observe the outcome of a participating firm ($Firm\ i$), Y_i^1. If there is no treatment effect, then the exchangeability assumption indicates that the counterfactual outcome of $Firm\ i$ (Y_i^0) would be the same as Y_i^1 had the firm not participated the program. Secondly, the stable unit treatment value assumption (SUTVA) asserts that the fact of whether or not a particular firm participates in the program would not affect the potential outcomes for other firms. In other words, the outcomes of firms are independent of other firms' participation decisions.

Once the exchangeability and SUTVA are satisfied, the expected effect of the workout for the firms that actually participated, or the average treatment effect on the treated (ATT), can be measured as follows.

$$\begin{aligned} \tau_{ATT} &= E(Y_i^1 - Y_i^0 | T_i = 1) \\ &= E(Y_i^1 | T_i = 1) - E(Y_i^0 | T_i = 1) \end{aligned} \tag{13}$$

In equation (13), however, we still do not observe both cases of $(Y_i|T_i = 1)$ and $(Y_i|T_i = 0)$ at the same time for the particular $Firm\ i$. In order to evaluate how effective the workout program was, it is necessary to compare the firms that participated in the program with the firms that did not participate in it. However, the causal effect of the treatment (the workout program) can be estimated by merely comparing the treatment group (the participants) with control group (non-participants).

To derive a causal effect, we need to rely on strong ignorability (Rosenbaum and Rubin, 1983) to avoid selection bias which is prevalent in observational data. That is, conditioning on covariate distribution, X, the selection bias disappears. In other words, given two firms have the same covariate distribution of X, we do not guess which one is the treated or the control. This will mimic the random assignment in

experiment.

$$\begin{aligned}\tau_{ATT}|(T_i = 1) &= E(Y_i^1|X_i, T_i = 1) - E(Y_i^0|X_i, T_I = 1) \\ &= E[E(Y_i|X_i, T_i = 1) - E(Y_i|X_i, T_i = 0)|(T_i = 1)]\end{aligned} \tag{14}$$

To conduct such a study in a lab experiment setting, participants need to be *randomly* assigned to either the treatment group or the control group, for only then might we infer any measured differences between the groups *must* have been caused by the presence (or absence) of the treatment. In contrast, relying on observational data entails a major obstacle to being able to infer causal effect, because whether firms participated in the workout program or not was *not* the result of a random assignment process. When assignment to the treatment group is non-random, as in this case, the treated group and the control group can be considered to have been drawn from different populations, and if so, then any attempt at comparison done without correcting systematic differences between the groups can lead to biased estimates (Basu et al., 2007, 2008; Jones, 2007; Sekhon and Grieve, 2012). In other words, the treated group and the control group are very likely to differ in terms of certain characteristics that affect both the outcomes and the selection process of whether they received the treatment or not. If we fail to control for those characteristics, we cannot attribute the measured differences in performance between the two groups to the treatment itself, for the differences in outcome are also probably affected by numerous other "confounding factors" and differences between the treated group and the control group (Gilligan and Sergenti, 2008).

When it is not possible to pursue genuine randomized experiments, the next best strategy is to "try to mimic randomization - that is, try to have an observational

analogue of a randomized experiment." In other words, we select the control group to be as similar to the treated group as possible in terms of observed characteristics (Khandker et al, 2010). The method of "matching" aims to achieve this purpose. Assuming that a decision of participation is based solely on differences in observed characteristics, and that enough nonparticipants are available to match with participants, the effect of treatment can theoretically be measured even if the treatment has not been randomly applied (Khandker et al, 2010). Matching is a specific method used to equate (or "balance") the distribution of characteristics between the treated and control groups (Stuart, 2010). Once we make two groups as similar as possible in their characteristics (potential causal variables), any difference between the two groups can be attributed to the treatment (Gilligan and Sergenti, 2008).

In such a study, the challenge is to match two groups based on multi-dimensional characteristics. In 1983, the propensity score matching method (Rosenbaum and Rubin, 1983) was introduced to avoid the "curse of dimensionality" due to matching in multi-dimensional characteristics. Rather than attempting to match in terms of all the potentially confounding characteristics, the propensity score matching method matches two groups on the basis of a scalar propensity score: the probability of participating conditional on their different observed characteristics (Rosenbaum and Rubin, 1983; Khandker et al, 2010). Rosenbaum and Rubin (1983) show that, under certain assumptions, matching on a scalar of propensity score ($P(X)$) is as good as matching on a vector of various characteristics (X). In other words, this propensity score theorem proves that if systematic bias disappears conditional on all the explanatory variables, then the bias also disappears conditional only on the scalar value of propensity score.

In practice, however, the true propensity score model is unknown, and a misspecified model can lead to bias (Drake, 1993; Ramsahai, Grieve, and Sekhon, 2011).

To evaluate whether the propensity score model is correctly specified, we must investigate the balance of characteristics between the treatment and control groups (Ho et al. 2007; Austin 2009; Ramsahai, Grieve, and Sekhon, 2011). If the model does not provide "covariate balance," researchers should continue to modify the model and check the balance until it does provide "covariate balance" (Rosenbaum and Rubin 1984; Sekhon and Grieve, 2012). This manual process of iteratively modifying the propensity score model to obtain covariate balance is challenging, and does not appear to be followed in causal modeling studies (Austin, 2008; Ramsahai, Grieve, and Sekhon, 2011).

4.4.2 Genetic Matching method

To avoid such misspecification of a model and instead achieve the covariate balance directly, this chapter uses a recently-developed matching method: Genetic Matching.[64] Genetic Matching is an automated approach which algorithmically optimizes covariate balance (Diamond and Sekhon 2012; Sekhon 2011). This newly developed matching method has been recently used in other similar studies (e.g. Gilligan and Sergenti, 2008; Mayer, 2011.)

In terms of distance measure, Genetic Matching uses a generalized version of Mahalanobis distance (Rosenbaum and Rubin, 1985). The Mahalanobis distance is a distance measure between two multi-dimensional vectors.

Roughly speaking, "a difference of one standard deviation counts the same for each covariate" (Rosenbaum, 2010). In other words, Mahalanobis distance measures the distance in terms of covariates' standard deviation (the unit of distance can be

[64]See Imbens and Wooldridge (2009) for reviews of the recent developments in the econometrics of program evaluation. See also Imbens (2004) for a review of nonparametric estimation of average treatment effects.

roughly considered standard deviation).[65] Technically speaking, Mahalanobis distance is measured by the distance between two vectors (X_i and X_j) adjusted by their covariance matrix (S), as expressed in Equation (15).

$$Mahalanobis\ Distance(MD) : MD(X_i, X_j) = \sqrt{(X_i - X_j)^T S^{-1} (X_i - X_j)} \quad (15)$$

The original purpose of developing the Mahalanobis distance was to use this distance for multivariate Normal data, and it behaves awkwardly with non-normal data such as binary data or data with extreme outliers (Rosenbaum, 2010). This problem is mainly due to the inflexibility of the measure. The generalized Mahalanobis distance used in Genetic Matching add the weight parameter (diagonal matrix) to flexibly adjust the relative distance (relative importance) in measuring the distance between multi-dimensional vectors. Genetic Matching will involve searching the optimum weight (W) in order to find the optimum solution of minimized distance between the two vectors, as defined in Eqaution (16).

$$Generalized\ MD : GMD(X_i, X_j, W) = \sqrt{(X_i - X_j)^T S^{-1/2} W S^{-1/2} (X_i - X_j)} \quad (16)$$

In order to search for the optimum weight (W), Genetic Matching uses a genetic algorithm inspired by the process of *natural evolution*. By mimicking the process of natural evolution, a genetic algorithm iteratively checks and improves covariate balance. Genetic algorithm is a "heuristic approach to finding near-optimal solutions in large search spaces" (Davis, 1991; Goldberg, 1989; Holland, 1975; Wang, et al,

[65] This rough description of the Mahalanobis is intuitively helpful, but is technically not quite correct Rosenbaum (2010).

1997). Starting with a random initial solution, the procedure generates new generation of population by iteratively applying the genetic operators (selection, crossover, and mutation), evaluates each generation of population using a fitness function, and chooses the best candidate solution (Horner, et al., 1993). In Genetic Matching, the Genetic algorithm searches among a range of distance metrics to find the particular measure that optimizes post-matching covariate balance (Diamond and Sekhon, 2012). In other words, it searches the weight of each confounding factor (W in equation (16)) in order to obtain optimal covariate balance (Sekhon, 2011, Sekhon and Mebane, 1998; Gilligan and Sergenti, 2008).

The procedure of Genetic algorithm starts with inherited initial population of candidate solutions of W (e.g. five thousand of individual candidate solutions of W in a population). Each W in the population provides different matching results of the treated and the control. Each matched results according to each W then is evaluated by a fitness function, which is the covariate balance in our case. The less the imbalance of covariate distribution between the treated and the control groups, the more fitted the value of fitness function is given. *Selection process* then preserves best fitted candidates within the population, and selects out the candidates with less fit. *Crossover process*, a counterpart of sexual breeding, recombines parts of candidates and creates new combinations of candidates in searching better fit. *Mutation process* randomly modifies the elements of individual candidates of W to explore better fitted candidates.[66] These procedures provide the next generation of the population, in which each candidate W results in different matches. Each match created according to the new population of W is evaluated by the fitness function, and the same genetic procedures follow. Genetic algorithm iteratively goes through the genetic procedures

[66]Technically speaking, "mutation is a hill-climbing operator that drives exploration of the local fitness landscape around a candidate solution.(Horner, et al., 1993).

until it obtains the optimum solution of W.

To construct an appropriate comparison group, this chapter performs one-to-one nearest neighbor matching, using *GenMatch* (Sekhon, 2011).[67] Among non-participant firms, this matching method selects one nonparticipant which matches as closely as possible to each participant. The resulting control group (nonparticipants) and the treatment group (participants) are, on average, similar in various characteristics except whether they participated in the workout program or not. By comparing these matched firms, we can make inferences of the causal effect of the workout program.

4.5 Data Sources

The main source of data for the firms that went through "workout program" was the KIS-VALUE database created by the Korea Investors Services (KIS). The KIS-VALUE provides the information of the entire list of firms that went through workouts. It also offers the information both on the listed firms and on unlisted firms subject to an external audit.[68] KIS-VALUE provides company profiles and financial information for Korean firms since the early 1980s. Although it includes the information on some of closed firms, KIS-VALUE restricts this information only for the delisted firms, and thus the closed firms that have not been listed are not included in the database. To mitigate this drawback, the KIS-Value database is complemented by KIS-LINE database (also compiled by KIS), which contains information of exited firms. Some of missing data are further complemented by an additional database compiled by the Korea Listed Companies Association (KLCA), which provides financial

[67] This study uses R package *"GenMatch,"* developed by Sekhon (2011).

[68] In Korea, firms greater than a certain size are subject to external audit. This criterion has been changed several times. For example, under the regulations which took effect in 2009, firms with assets greater than 10 billion won (approximately $10 million) are subject to an external audit in Korea.

information on the publicly-listed companies beginning in 1981.

In the combined database, this study restricts the sample to the manufacturing sector.[69] The sample excludes the firms that had experienced the process of composition or reorganization right before the crisis. The sample also excludes the firms that have changed their main industries since the crisis (e.g. Shinwoo, Korea Polimer, Daewoo Telecom, and Hankook Computer holding company). The exiting times are corrected to be earlier than actual ones if the firms are practically bankrupt or cannot be considered to be in normal operation; this is the case, for instance, when the number of employees of firms suddenly decrease to unreasonable numbers and then the firm exit in a few of years; when firms stop report financial information and then exit in a few years.[70]

Outliers which cannot find reasonably similar control counterparts are excluded in the sample. These excluded outliers are (a) affiliate members of *Kohap* group, (b) firms in automobile industry, and (c) *Daewoo Heavy Industries CO.,Ltd.* First, *Kohap* group already experienced troubles in their operation before the crisis, and their affiliates went through significant changes even before the crisis. Therefore affiliate members of *Kohap* group are excluded in the analysis. Secondly, automobile industry is an oligopoly industry in which three major firms (Hyundai, Kia, and Daewoo) are mostly dominant and the market shares of the rest of minor firms (e.g. Ssangyong and Samsung) are extremely marginal. The firms in the industry are quite heterogeneous. In addition, the industry experienced a series of mergers and acquisitions during

[69] Firms that changed their industry during the sample period are also excluded in the sample.

[70] For example, *Kapul* reported its value-added information only until 2003, and it disclosed and disappeared from the sample soon after. *Daewoo Electronics* reported its employees as 4300 in 2003, but its employees suddenly dropped to only two people in 2004. It eventually disclosed later. Therefore it is considered to have exited in 2004. *Hanil Textile*'s number of employees dropped from 864 in 2003 to 19 in 2004, and disclosed later. Hanil Textile is considered to have exited in 2004. Haepyo Food reported its number of employee as 150 in 2001, did not report in 2002, and reported zero in 2003. Haepyo Food is considered to have exited in 2002.

the crisis, and thus the performance changes cannot be appropriately attributable.[71] Therefore, firms in the automobile industry are excluded in the analysis. Finally, Daewoo Heavy Industries was extremely big and went through extremely severe underperformance, and thus cannot find any reasonably close controlling counterpart.

4.6 Results

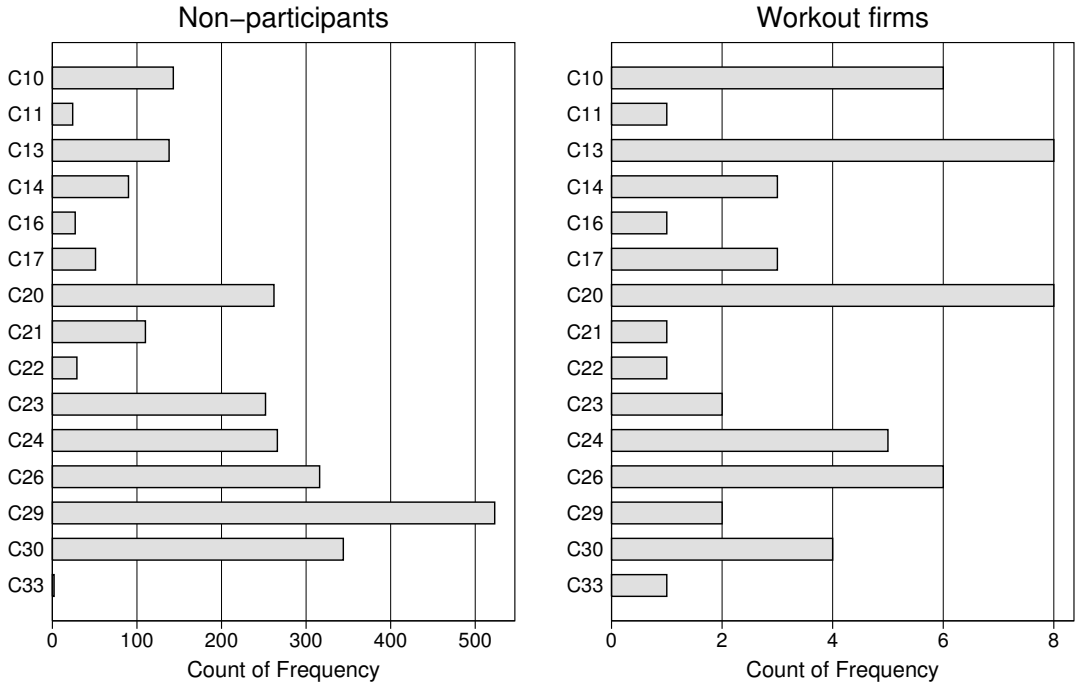


Figure 7: The Industry Distribution

In our sample, the number of non-participants is approximately 1,300, while that of workout firms is 56.[72] Figure 7 displays the number of workout firms and non-

[71] During the crisis, Kia Motors was acquired by Hyundai Motors, Ssangyong Motors was acquired by Daewoo Motors, and Daewoo automobile was eventually acquired by General Motors.

[72] As mentioned before, Daewoo heavy industrial and firms belong to Kohap business group are excluded in our analysis, because they are really outliers with no similar firms in the economy.

participant firms by industry. In each industry, the non-participant group contains reasonably sufficient number of firms that can be matched with workout firms.

Using *Genatic matching method*, we match workout firms with non-participant firms in terms of various confounding covariates at year 1996, immediate before the 1997 crisis.[73] Specifically, this study uses one-to-one matching with replacement.[74] The method found 36 matches of workout firms and control firms that are in the same industry. The rest 23 of matches, however, are closely but not exactly matched in terms of industry.

There are various measures of checking balance of matched samples. Recent studies note the importance of using standardized, nonparametric measures such as empirical Quantile-Quantil plots (Q-Q plot) (Ho et al., 2007; Austin, 2009; Sekhon and Grieve, 2012). The fundamental idea behind the Q-Q plot is a graphical method to compare the cumulative probability of one sample with that of another sample distribution. Q-Q plot which is close to 45 degree line indicates that two samples are alike in their cumulative probability. Specifically, the Engineering statistics handbook explains Q-Q Plots as follows.[75]

> The quantile-quantile (q-q) plot is a graphical technique for determining if two data sets come from populations with a common distribution. A q-q plot is a plot of the quantiles of the first data set against the quantiles of the second data set. [...] A 45-degree reference line is also plotted. If the two sets come from a population with the same distribution, the points should fall approximately along this reference line. The greater the departure from this reference line, the greater the evidence for the con-

[73] See Sekhon (2013) for the description of *GenMatch* in R.

[74] As ? notes, matching without replacement provides matching results with low balance.

[75] NIST/SEMATECH e-Handbook of Statistical Methods, http://www.itl.nist.gov/div898/handbook/eda/section3/qqplot.htm

clusion that the two data sets have come from populations with different distributions.

Figure 8 displays the empirical Q-Q plots of covariates in the matched samples: Treated vs. Control groups. In this figure, all covariates fall reasonably close to the 45% reference line, indicating that two groups can be considered alike in their distribution of the covariates.

To quantitatively analyzing the balance of covariates between the two groups, this study further investigates two widely used test statistics: the t-test on the difference of means and the Kolmogorov-Smirnov test.[76] The Kolmogorov-Smirnov (K-S) test is widely used in the studies using matching. Wilcox (2005) provides a good description of this measure.[77] It tests the null hypothesis that two distributions are identical, $H_0 : F(x) = G(x)$ with $F(x)$ and $G(x)$ being cumulated distributions. K-S test measures the *Kolmogorov distance* between the two distributions, which is defined as the maximum possible value of $|F(x) - G(x)|$. This distance can be visualized in graphs as the largest vertical distance between the two cumulative distribution functions. Sufficiently large Kolmogorov distance provides sufficiently low p-values, and thus rejects H_0. In other words, high p-values of the test indicates that the distributions of covariates from two matched samples are *not* statistically different each other. This is also the case of t-test that tests the null hypothesis that two groups are identical. Therefore, high p-values in both tests support a covariate balance matched well between the treatment group and the control group.

Table 4 display those tests for before and after the matching. Overall, the test statistics indicate that the covariate balance has been substantially improved after the

[76] As Sekhon (2013) explains why the standardized statistics on checking balance should not be used as hypothesis tests. This is "because no measure of balance is a monotonic function of bias and because balance should be maximized without limit" (Sekhon, 2013).

[77] The description on the Kolmogorov-Smirnov test in this section draws heavily upon Wilcox (2005).

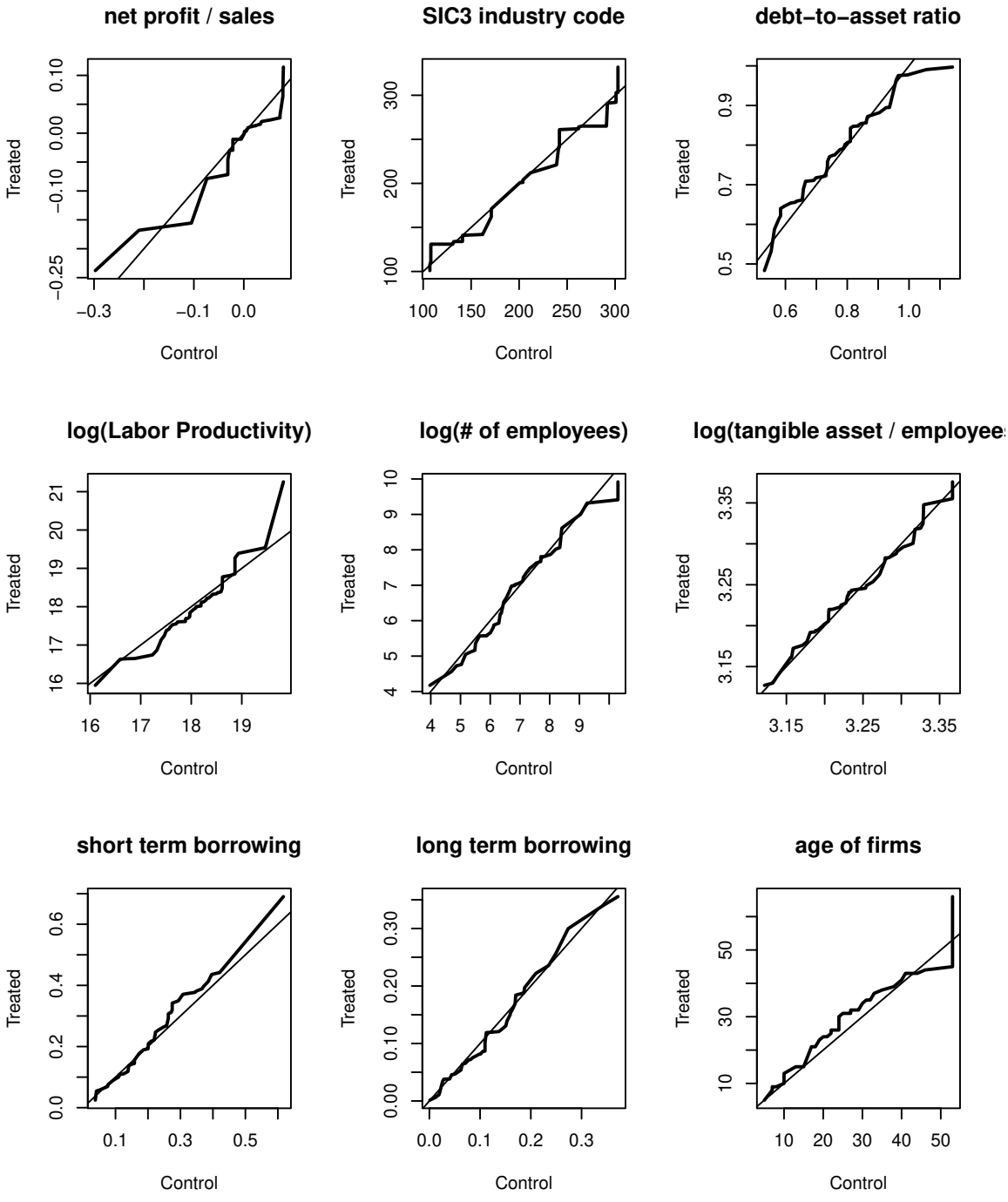


Figure 8: QQ-Plot of Matched Distribution

Table 4: Balance Statistics (before matching vs. after matching)

Variable	Mean treatment		Mean control		t-test p-value		K-S test p-value	
	Before	After	Before	After	Before	After	Before	After
Industry (SIC3)	193.38	193.38	229.39	192.93	0.00065855	0.75999	0.003	0.998
Labor Productivity	63728233	63728233	51374053	65479600	0.026749	0.7075	0.003	0.826
nprofy	-0.0024923	-0.0024923	-0.13637	0.0083186	0.13534	0.36462	<2.22e-16	0.207
oprofy	0.072659	0.072659	0.0042655	0.074722	0.025385	0.86554	0.13	0.94
log(employee)	6.68	6.68	4.7552	6.6801	2.0872e-14	0.9997	<2.22e-16	0.927
log(asset)	21.66	21.66	19.073	21.631	<2.22e-16	0.43477	<2.22e-16	1
log(liabilities)	21.386	21.386	18.784	21.353	<2.22e-16	0.38815	<2.22e-16	1
Tangible asset	148178607	148178607	108899435	123560395	0.04777	0.15829	<2.22e-16	0.31
lsales	25.897	25.897	23.568	25.995	<2.22e-16	0.12131	<2.22e-16	0.433
Debt/Asset	0.76939	0.76939	0.78506	0.7735	0.3967	0.82798	0.224	0.313
Age	28.222	28.222	14.852	26.6	1.1857e-08	0.30804	<2.22e-16	0.975
Long-term borrowing/asset	0.094982	0.094982	0.14918	0.085085	7.1288e-05	0.14785	0.007	0.786
Short-term borrowing/asset	0.22041	0.22041	0.22639	0.21665	0.77054	0.73412	0.449	0.787

matching. In general, these tests show that the distributions of matched samples are not significantly different. Even after matching, however, some of covariates are not perfectly indifferent between the treatment and control groups (e.g. tangible assets, log(sales), and Long-term borrowing divided by total asset).

Table 5 displays the regression results of the effect of the workout program on the labor productivity in 2002, using the matched samples. The column (1) can be considered as t-test of whether the workout participants and matched non-participants are statistically different in their labor productivity in 2002. The analyses further include some other covariates in the base year of 1996, a year before the crisis occurred. The results do not show any statistical difference due to the workout participation. Column (2) and Column (5) indicate that the productivity in 2002 is strongly related to the productivity in 1996, and the workout program did not appear to contribute to additional productivity improvement.

Table 6 demonstrates the regression results of the effect of the workout program on the productivity growth between 1996 and 2002. The results presented in this table are very consistent with those in the previous analyses with absolute level of labor productivity. Among relevant covariates on the base year of 1996, the labor productivity had the most explanatory power for the future productivity level and growth (columns (2) and (5) in both cases). The year 2002 is chosen in the analyses, because 2002 is expected to be relatively long enough for firms to realize their benefits from the program, while it is relative short enough for the effect of the program did not diluted by other effects in the long term. The same regression analyses with different time periods, such as 2004 and 2006 also provide consistent results (See Appendix A and B in this dissertation).

Table 5: Regression Results of the Workout Effect on Productivity (2002)

Dependent Variable: Labor productivity (2002)	(1)	(2)	(3)	(4)	(5)	(6)
Workout Participation	-49.645	-36.560	-36.288	-18.881	-11.046	-19.543
	(52.904)	(47.296)	(46.514)	(46.078)	(41.631)	(43.773)
Industry Effect				Yes	Yes	Yes
Labor Producivity ('96)		2.707***	1.934		3.008**	1.976
		(0.648)	(0.992)		(0.933)	(1.276)
Employee ('96)			-0.031			-0.036
			(0.040)			(0.043)
Asset ('96)			0.010			0.030
			(0.038)			(0.045)
Tg Asset ('96)			0.386			0.455
			(0.381)			(0.376)
Liabilities ('96)			0.036			-0.005
			(0.043)			(0.057)
Sales ('96)			-0.000			-0.000
			(0.000)			(0.000)
Net profit ('96)			0.002			0.000
			(0.002)			(0.003)
Operating Profit ('96)			-0.003*			-0.001
			(0.002)			(0.002)
Constant	115.577**	-67.015	-57.062	68.743	104.885	-46.760
	(38.526)	(55.621)	(66.818)	(169.302)	(153.050)	(274.127)
Observations	66	66	66	66	66	66
R-squared	0.014	0.227	0.412	0.635	0.711	0.779

Note: Standard errors in parentheses. *** p <0.001, ** p <0.01, * p <0.05.

Table 6: Regression Results of the Workout Effect on Growth of Productivity (1996-2002)

Dependent Variable: Growth of productivity (96-02)	(1)	(2)	(3)	(4)	(5)	(6)
Workout Participation	-44.812	-36.560	-36.288	-16.277	-11.046	-19.543
	(49.331)	(47.296)	(46.514)	(43.363)	(41.631)	(43.773)
Industry Effect				Yes	Yes	Yes
Labor Producivity ('96)		1.707*	0.934		2.008*	0.976
		(0.648)	(0.992)		(0.933)	(1.276)
Employee ('96)			-0.031			-0.036
			(0.040)			(0.043)
Asset ('96)			0.010			0.030
			(0.038)			(0.045)
Tg Asset ('96)			0.386			0.455
			(0.381)			(0.376)
Liabilities ('96)			0.036			-0.005
			(0.043)			(0.057)
Sales ('96)			-0.000			-0.000
			(0.000)			(0.000)
Net profit ('96)			0.002			0.000
			(0.002)			(0.003)
Operating Profit ('96)			-0.003*			-0.001
			(0.002)			(0.002)
Constant	48.136	-67.015	-57.062	29.656	104.885	-46.760
	(35.924)	(55.621)	(66.818)	(159.327)	(153.050)	(274.127)
Observations	66	66	66	66	66	66
R-squared	0.013	0.111	0.323	0.628	0.667	0.745

Note: Standard errors in parentheses. *** p <0.001, ** p <0.01, * p <0.05.

4.7 Conclusion

Large scale corporate restructuring during a systemic financial crisis is probably one of the most daunting challenges for policymakers, and governments are required to take a leading role in such a large scale restructuring (Stone, 2000). During a systemic crisis, hundreds or thousands of firms simultaneously experience severe financial distress. Their distress is not necessarily due to their own long term economic insolvency, but rather due to macroeconomic circumstances beyond their control (Meyerman, 2000). If they could receive the necessary assistance during the financial crisis, the majority of these distressed firms may be able to achieve the long-term prosperity. In such situations, a "workout", an out-of-court, voluntary debt-restructuring process, has been considered a desirable approach for corporate sector restructuring (Mako, 2005)

Because such "workouts" are the most feasible and possible restructuring schemes during a financial crisis, literature emphasizes the evaluation of the workout program in terms of actual performance improvement (e.g., Kang and Hang, 2001; Kang, 2004). Previous studies evaluating the performance of workouts, however, suffer from so-called selection bias in their estimation. To avoid such systemic bias when investigating workouts in 1997 Korean financial crisis, the present study utilizes the *Genetic Matching* method (Diamond and Sekhon 2012; Sekhon 2011) to balance the distribution of confounding covariates between the workout participant group and the control group.

Our results show that the effect of workout programs on the productivity of participant firms is *not* statistically significant. The performance of workout firms is not different from that of firms in the control groups, which did not go through a workout program but whose characteristics are otherwise very similar to those of the participants. In other words, this chapter finds that any productivity improvement of

workout participants is hard to be attributed to a causal effect of the workout program itself. Indeed, this finding is consistent with some concerns raised in some previous literature. That is, the workout program may have achieved (and have aimed at) short-term economic stability at the cost of improving long-term economic efficiency (Kang and Hahn, 2001; Park, 2003; Kang, 2004).

The finding of this chapter is also consistent with that reported in Chapter 3. Motivated by self-interest of involved parties, a "workout" (London approach) is in theory beneficial to all the parties, and helps improve the performance of firms. However, during a financial crisis, the incentives of financial institutions or governments are different than they are in normal times. During a systemic crisis, financial institutions also face the threat of their own institution's insolvency, and therefore their incentives to survive can distort the overall direction of corporate restructuring (Park, 2003). This means that, by their very nature, workout programs may represent a very inefficient pattern of resource allocation within the economy. Furthermore, as Park (2003) points out, "Credit banks mostly focused on supplying liquidity through debt restructuring without seeking fundamental changes in the troubled firms' operations."

One of positive effects of a crisis would be its stimulation of restructuring and re-constructing of the economy. A significant amount of literature has indeed claimed that a crisis may contribute to long-term economic growth because it can alleviate factors that had previously interfered with restructuring activities during normal times (Rodrik, 1996; Stone, 2000). If the restructuring schemes implemented during crises do not emphasize performance improvement, the economy may be losing precious opportunities that are difficult to pursue in normal times. Although rapid recovery from a crisis and achievement of overall stability of the national economy is important, the policy makers also need to be concerned that resources are not wasted in fruitless, mere cosmetic restructuring efforts. Countries experiencing financial crises may need

to consider how they can obtain the most benefit out of their crises, and should not to overlook the valuable opportunities that the crisis may offer.

This study attempts to investigate the effectiveness of workouts during a financial crisis, but it is important to acknowledge some of the limitations of this study. First, this study investigated only one single country, and the ability to generalize the results to other nations may therefore be limited. Further studies using observations of different countries will reveal the effect of workouts in various other economic settings, which might well be different from that of Korea. Secondly, this study also suffers from the same limitation that is shared by most other causal modeling studies which rely upon observational data. That is, the effect of the workout program in this study is based on the effect on only the particular sample of firms that actually participated in the workout program during the 1997 Korean financial crisis. Therefore, the results of this study are not directly applicable to all corporations of Korea, let alone the effects on the firms outside Korea. Future analyses investigating other countries will alleviate this inherent limitation of this study. Finally, the number of observations is usually restricted in a study of this type. More sophisticated methods that may be developed in the future might be able to extract more information from their analyses than it was possible to do in this study. I hope the limitations of this study will motivate further studies into these matters which may have greater scope and depth.

5 THE STRONGER GETS STRONGER: HOW THE FINANCIAL CRISIS STRENGTHENED KOREAN BUSINESS GROUPS

> "Yes, this is a moment of challenge for our country, [...] each generation has found the capacity to not only endure, but to prosper to discover great opportunity in the midst of great crisis."
>
> — *Barack Obama, the forty fourth president of the U.S.*

5.1 Introduction

The economies of all regions occasionally experience periods of depression and adversity. How do such disastrous periods affect various agents within these economies? *Natural selection theory* (Darwin 1859) provides the insight that each environment selects individuals which are best adapted to it. Any abrupt or drastic change in the environment can lead to a discontinuous selection process that will determine which will survive and become stronger, and which will be eliminated. The external environment determines "the rules of the game in a society," or "institutions" (North,

1990). Firms' prior fit with old institution may not guarantee "continued legitimacy and even survival" (Lee, Peng, and Lee, 2008), and thus firms' capability to adapt to their new environment (institutions) is substantially important for the long term performance and survival.[78] For example, the dinosaurs, which were presumably the strongest of their own era, could not survive at all in the altered environment of the period that came later.

In terms of the range and severity of damaging effects, a financial crisis in the modern economy can arguably be comparable to the asteroid that led to the extinction of dinosaurs. Systemic financial crises bring about the collapse of asset markets, profound declines in output and employment, and an explosion of government debt (Reinhart and Rogoff, 2009). Especially, the absence of a well-functioning financial sector during financial crises makes it much more difficult for the economy to recover from a distressed period (Gokhale, 2009). Indeed, financial crises have resulted in growth of restructuring activities by Latin American and Asian companies (Hoskisson, Jr, Tihanyi, and Faraci, 2004).

In history, financial crises occurred more frequently in developing countries. In such developing economies, there exist business organizations that are arguably comparable to dinosaurs, namely, business groups. A business group is a group of *legally independent* firms, operating in multiple (often unrelated) industries, which are under centralized control (e.g., usually a controlling family) (Chang and Hong, 2002; Khanna and Yafeh, 2007). Business groups are extraordinarily important for "performance and the structure of [their] economy" (Choi and Cowing, 2002). The top 30

[78] In the field of management, there is controversy about how easy it is for organizations to make the necessary changes demanded of them when confronted by radical changes in their environment. In this line of literature, Chang (2003) summarizes the two opposing views; adaptation theorists (March and Simon, 1958; Katz and Kahn, 1966; Hamilton and Biggart, 1988) believe that effective organizations can adapt to changes in their environment, while organizational ecologists (Hannan and Freeman, 1977; Tushman and Romanelli, 1985) emphasize *inertia* that prevents organizations from adapting to environmental change.

business groups in Korea, for example accounted for 36.6% of total value added, 52.5% of equity, 46.4% of sales, 30.1% of profits, and 13.8% of employees in the manufacturing sector in 1996 (Beck, 1998).[79] The importance of business groups in the national economy makes vitally important to understand how a financial crisis affects business groups. Literature has emphasized its importance, claiming that "restructuring by business groups is one of the most important challenges firms and governments face in many countries" (Hoskisson et al, 2001; Hoskisson et al, 2004; Khanna and Palepu, 1999b).

When confronted with a financial crisis, will business groups follow the same destiny of dinosaurs, or will they be capable of turning a crisis into an opportunity to achieve higher competitiveness in the next era? Indeed, a financial crisis can provide rare opportunities in which business groups rearrange their affiliate portfolio and rationalize their individual businesses. To obtain useful insights regarding this question, this study investigates how the change in composition of affiliate networks contributed to their group productivity and to the efficient allocation of resources among their affiliates ("allocative efficiency"). The change of affiliate configuration to respond with these rare opportunities and threats of a financial crisis is closely related to the concept of *business portfolio restructuring*. Portfolio restructuring entails acquisitions and divestitures to change a configuration of businesses. Literature argues that business portfolio restructuring (also referred to as asset restructuring) is a prevalent method for organizations to deal with opportunities and threats from the external environments (Duhaime and Grant, 1984; Hitt, Harrison, and Ireland, 2001; Hoskisson and Hitt, 1994; Hoskisson et al, 2004; Markides, 1992).

Although literature has emphasized its prevalence and importance of portfolio

[79] According to Beck(1998), the original source is the National Statistical Office, Bank of Korea, in *Korea Economic Weekly*, January 19, 1997.

restructuring, it has suffered from the lack of a systematic tool to look inside the restructuring procedures. To investigate how the performance change of a group can be attributed to each activity of such restructuring, this study is first to apply the technique of *productivity decomposition* developed in the field of *Industrial Organization*. Specifically, this study explains the change of group composite productivity during the financial crisis with the four contributing sources: (a) the change in the average productivity of continuing affiliates, (b) productivity contribution by newly joining affiliates, (c) productivity contribution by shedding affiliates; and (d) productivity contribution by re-allocating resources among affiliates (reaching higher *allocative efficiency*).

This chapter is organized as follows. Section 5.2 explains the concept of business groups. Section 5.3 reviews relevant literature. Section 5.4 examines the possible reactions of business groups during a financial crisis. Section 5.5 describes the situation Korean business groups confronted during the 1997 financial crisis. Section 5.6 describes the data sources. Section 5.7 presents empirical analyses and results. Section 5.8 discusses and concludes.

5.2 Business Groups

Business groups are a dominant organizational form in managing large businesses outside North America (Yiu, Lu, Bruton, and Hoskisson, 2007), especially emerging countries. In most emerging countries, various market failures due to the absence of appropriate intermediaries make it costly for the firms to obtain the business resources, such as financing, technology, and management talent (Khanna and Palepu, 2000). Under such market failures, diversified business groups are a rational response (Leff, 1978; Khanna and Palepu 1997; Amsden, 2001; Schneider, 2010). In essence,

business groups in emerging economies "mimic the beneficial functions of market mechanisms that are present only in advanced economies" (Khanna and Palepu, 1997, 2000; Bae et al, 2008).[80] Forming business groups generates various benefits, such as economies of scale and scope, shared costs and risks, and access to complementary resources and distribution channels (Chang and Hong, 2000).

A business group is usually defined as "a gathering of formally independent firms under the single common administrative and financial control of one family" (Chang and Hong, 2000). Reviewing previous literature, Yiu et al. (2007) also provides one of the most comprehensive definition of a business group as follows.

> Business groups usually consist of individual firms that are associated by multiple links, potentially including cross-ownership, close market ties (such as inter-firm transactions), and/or social relations (family, kinship, or personal friendship ties) through which they coordinate to achieve mutual objectives (Granovetter, 1994; Khanna and Rivkin, 2001; Leff, 1978; Strachan, 1976; Yiu et al., 2005).

Although the exact characteristics of business groups differ across countries due to distinct country specific environment, they share important similarities such as unrelated diversification under centralized control (Chang, 2006a).

5.3 Literature Review

According to Bowman and Singh (1993) and Singh (1993), restructuring can be defined "a broad range of transactions, including selling lines of business or making sig-

[80]Diversified business groups are ubiquitous in emerging economies (e.g., Brazil, Chile, China, India, Indonesia, South Korea, Mexico, Pakistan, Thailand, etc.) (Khanna and Yafeh, 2007). The labels for business groups are different in different countries and regions; they are called keiretsu in Japan, *qiye jituan* in China, *business houses* in India, *grupos economicos* in Latin American countries, *grupos* in Spain, *chaebol* in South Korea, *guanxi qiye* in Taiwan, and *family holdings* in Turkey (Granovetter, 1994; Yiu et at., 2007).

nificant acquisitions, changing capital structure through infusion of high levels of debt, and changing the internal organization of the firm." Bowman and Singh conceptualize restructuring as consisting of three dimensions: (a) portfolio, (b) organizational, and (c) financial.[81]

As Hoskisson et al. (2004) note, the restructuring literature uses agency theory (Johnson, 1996) as the predominate means of explanation, and has come to be complemented by a line of research on the effect of the environment on restructuring (e.g. Ginsberg and Buchholtz, 1990; Rajagopalan and Spreitzer, 1997; Zajac and Kraatz, 1993). This line of restructuring literature views portfolio restructuring as "a strategic response by firms to changes in their environment" (Chatterjee, 1992; Hoskisson et al., 2004; Meyer, Brooks, and Goes, 1990).[82]

Literature further argues that business portfolio restructuring (also referred to as asset restructuring) is a prevalent method for organizations to deal with opportunities and threats from the external environments (Duhaime and Grant, 1984; Hitt, Harrison, and Ireland, 2001; Hoskisson and Hitt, 1994; Hoskisson et al, 2004; Markides, 1992). Among changes in global environment, financial crises have resulted in growth of restructuring activities (Hoskisson, et al., 2004). Therefore it makes important to understand the restructuring phenomena in the context of financial crises.

Historically, financial crises have occurred relatively frequently in developing countries in which business groups usually exist as dominant players. The importance of

[81]Bowman and Singh (1993) describe that portfolio restructuring (or, business portfolio restructuring) entails acquisitions and divestitures to establish a configuration of the lines of business. They define organizational restructuring as involving changes in organizational structure to enhance the performance of the management team. Finally, financial restructuring usually entails the infusion of debt. In the literature, portfolio restructuring is also termed as asset restructuring; organizational restructuring is named as management restructuring; financial restructuring is called capital structure restructuring. See Bowman and Singh (1993) for detailed description of the three types of restructuring.

[82]For examples, Bergh and Lawless (1998) find that fairly diversified firms are inclined to divest when environmental uncertainty increases and inclined to acquire when environmental uncertainty declines (Hiskisson et al., 2004).

business groups for their developing economies calls for investigation of the portfolio restructuring by business groups during financial crises. The importance of the subject is further acknowledged, because "restructuring by business groups is one of the most important challenges firms and governments face in many countries" (Hoskisson et al, 2001; Hoskisson et al, 2004; Khanna and Palepu, 1999b). The current study investigates the performance of portfolio restructuring by business groups during the 1997 financial crisis in South Korea to contribute to restructuring literature and to literature on business groups.

Despite the importance of business groups in regions outside of North America, until recently, the research on business groups has been highly fragmented (Yiu, Lu, Bruton, and Hoskisson, 2007). To stimulate an integrated model for the research on this subject, Yiu et al. (2007) have reviewed the major theoretical perspectives on business group research. This includes: (a) the transaction cost theory and external market conditions (Coase, 1937; Williamson, 1975, 1981, 1985); (b) the view of relational perspective and social relationships (Granovetter, 1994; Guthrie, 1997; Keister, 1998, 1999, 2001; Whitley, 1991); (c) the perspective of political economy and political economic factors (Fields, 1995; Khanna and Palepu, 1999a; Nolan, 2001; Schneider, 1997); and (d) the agency theory and external monitoring and control systems (Dharwadkar et al., 2000).

In terms of subjects of the research on business groups, Chang (2003) classified previous research on business groups into four categories. First, one large body of literature claims that the "business group phenomenon" is best understood as being a creature of market imperfections prevalent in developing countries (e.g., Leff, 1978; Khanna and Palepu, 1997). A second cluster of literature explains the business group phenomenon as a result of governments artificially interfering in markets (e.g., Gerschenkron, 1962; Hirshman, 1958; Johnson, 1984; Amsden, 1989; Kim, 1997). A

third body of literature explains the characteristics of business groups in each country as being "culturally embedded" in their own specific national environment (e.g., Granovetter, 1995; Evans, 1995; Orru et al., 1997). Chang (2003) then suggests a dynamic perspective to understand how business groups evolve and why they persist over time. Following the resource-based view (Penrose, 1959; Lippman and Rumelt, 1982; Wernerfelt, 1984; Barney, 1986, 1991) and the evolutionary theory (Nelson and Winter, 1982; Teece, Pisano, and Shuen, 1997), Chang views business groups as entities that possess productive resources, and which engage in a continuous searching and selection process of their own environments to improve their performance.

In Korea, as Choi (2009) notes, the studies on Korean business groups in the context of the financial crisis have mostly focused upon the issue of Korean business groups as a culprit for the financial crisis and on the subject of the reform policy of the groups. In contrast, the effect of the financial crisis on performance (especially on productivity) of business groups has received limited attention, although the effect was not trivial. For example, more than 10 out of the top 30 Korean business groups went bankrupt during the 1997 financial crisis. Choi (2010) compares the bankrupt business groups with the surviving business groups, using the group level observations. Using simple methods of ANOVA and ANCOVA, he finds that bankrupt business groups maintained high debt-to-equity ratio for a long period before the crisis, had a higher proportion of listed affiliates, suffered from lower profit rate, and showed wider diversification.

In terms of the effect of the financial crisis on the productivity of Korean business groups, Choo, Lee, Ryu, and Yoon (2009) were the first to compare business group firms with non-group firms before and after the crisis. They report that, compared with the pre-crisis period, firms belonging to business groups became significantly more efficient than non-group firms after the crisis. Choo et al. (2009) also report that

business groups invested significantly *more* than non-group firms *before* the crisis, but they invested much *less* than non-group firms *after* the crisis. They further show that the over-investment practice of business groups prevalent before the crisis disappeared after the crisis, resulting in greater productivity improvement of business groups than non-group firms.

At the group level, the financial crisis also forced Korean business groups to eliminate low- performing affiliates. Among such low performers, business groups had to decide which affiliates to divest themselves of and which affiliates to internally consolidate. Choe and Roehl (2007) analyze this decision on divestiture and consolidation of affiliates in business groups. They find that surviving groups divested the businesses outside their core area or highly debt-ridden affiliates and became more focused on their core businesses, while failing groups did not show such efforts. Choe and Roehl (2007) further find that resumed expansion of business groups in the post-crisis period was mostly into areas closely related to their core businesses.

In a similar vein, the degree of diversification of conglomerates has been reported to decline during the period of financial crises (e.g. Hanani, 2006; Polsiri and Wiwattanakantang, 2006). After reviewing literature on diversification and economic performance, Choi and Cowing (2002) notes that empirical studies of firm performance and diversification have shown mixed results. Some of these measures, such as the number of affiliates and the degree of diversification based on Herfindahl-Hirschman index, may only be able to partially explain the changes in the affiliate network of business groups. For instance, it is possible for a business group to improve the performance of its affiliate portfolio while maintaining the same number of affiliates and the same degree of relatedness of the industries among its affiliates. Especially because there are substantial opportunities for a business group to restructure its affiliate network by obtaining new firms, by shedding unproductive affiliates, and by re-allocating the

resources among affiliates, we need to investigate such effects separately to understand how the opportunities provided during a crisis can affect the productivity of business groups.

This study is the first to investigate how each activity of portfolio restructuring contributes to the change in overall group productivity. Specifically, the productivity change of a business group can be decomposed by: (a) the average productivity change in continuing affiliates; (b) newly joining affiliates; (c) exiting affiliates; and (d) efficiently reallocating resources among affiliates.

5.4 The Cleansing and Pit-Stop Effects of a Financial Crisis in the Context of Business Groups

Portfolio restructuring is defined as a "change in the firm's configuration of lines of business through acquisition and divestiture transactions" (Bowman and Singh, 1993; Bergh and Lawless, 1998). This section describes the portfolio restructuring during a financial crisis from the perspective of the *cleansing effect* and the *pit-stop view*, which introduced in previous chapters of this dissertation.

Chapter 2 of this dissertation reviews the potential effects of financial crises on the productivity of the corporate sector in general. Specifically, Chapter 2 focuses on four main phenomena which occur during a financial crisis: (a) the so-called *cleansing effect*; (b) the *pit-stop effect*; (c) financial sector malfunction; and (d) government intervention. First, the advocates of the "cleansing effect" (Caballero and Hammour, 1994; Aghion and Saint-Paul, 1991) claim that, during a crisis, inefficiency or excessive surplus is *cleansed out* and resources are re-allocated toward the more efficient entities. These claims are based on the concept of "creative destruction" (Schumpeter, 1939; 1942). In other words, an economic crisis is seen as being able to contribute

to the overall efficiency (or productivity) of the economy by weeding out inefficient entities and by forcing the economy to pursue a higher level of *allocative efficiency* – more efficient entities survive and grow and less efficient entities shrink or disappear. Secondly, the *Pit-top view* (Aghion and Saint-Paul, 1991; Schuh and Triest, 1998) claims that depressed demand during recessions lower the opportunity cost of commitment to productivity-enhancing activities compared to production activities, and thus temporarily rebalance resource allocation between the two activities. In other words, during the period of an economic crisis, individual entities reduce their concentration upon production activities, and instead turn their resources toward efficiency-improving activities, such as readjustment and reorganization. (This process is likened to a brief rest and maintenance period during an automobile race). Finally, the abnormal behaviors and interests of financial institutions during a financial crisis and the intervention by government intended to improve the overall economic situation further affect the dynamics of efficiency gains of the economy.

Based on the same logic of the *cleansing effect* and *pit-stop* views, we can predict a financial crisis would resolve inefficiency in business groups in developing economies. We can consider the effect of a financial crisis at the group level (across groups) and at the affiliate level (within a group). First, *cleansing effect* of a financial crisis will selectively eliminate inefficient business groups at the group level. A crisis will force the upper echelon (usually a controlling family) of such an inefficient business group to step down from management, and dismantle the business group. At the group level, in this cleansing process, efficient affiliates in dismantled business groups will become independent or be acquired by new owners, while inefficient affiliates with no economic viability will disappear.

The *pit-stop effect* further provides a useful lens through which this cleansing process can be examined. During normal times, when the focus is on production, little or

no concern may be given to the fact that firms may be inefficiently managed, so long as the production remains high. In contrast, in order to improve long-term productivity at the expense of short-term production activities, an economic crisis time may force the corporation to resolve a significant portion of the mismatch between group ownership and affiliate membership. The affiliates which have been freed from the dismantled group will be reassigned to the new owners, who can then most effectively generate value from them, thus leading to an overall improved level of productivity for the economy in general. This reshuffling process also provides opportunities for smaller but more efficient business groups to grow and replace the inefficient larger business groups. This implies that a crisis period *decreases* the advantage of business groups that results merely from their large size, and *increases* the advantages of business groups which results from their greater efficiency.

At the affiliate or firm level within surviving business groups, a financial crisis forces a business group to rationalize (cleansing effect), and also to revitalize (pit-stop effect) their businesses. Based on the perspective of the cleansing effect, we can predict that a financial crisis forces surviving business groups to close, merge, or sell off their inefficient affiliates. Based on the pit-stop view, we can further anticipate that a financial crisis offers many potential M&A deals at bargain prices, and provides opportunities to a business group to complement and reinforce their affiliate portfolios. Each affiliate within a group can rationalize and revitalize its own business, thus contributing to overall improved group level productivity. A business group can further increase overall group level productivity by moving its internal resources toward more productive affiliates. Indeed, achieving this allocative efficiency among agents is the main driving force of the cleansing effect.

In summary, the cleansing process is expected to enhance the productivity of business groups by removing inefficient elements within business groups, while the

pit-stop process further improves such productivity by allowing reorganization and re-construction of the surviving elements *within* and *across* business groups. The overall productivity improvement of a business group is derived from various sources: (a) productivity gains, resulting from the improvement of average productivity of its affiliates (*average productivity improvement*); (b) productivity gains, the result of moving resources toward more productive affiliates (*allocative efficiency*); (c) productivity gains, resulting from acquiring new firms or launching new affiliates (*entry effect*); and (d) productivity gains, derived from to dissolving of unproductive affiliates (*exit effect*).

5.5 Korean business groups (Chaebol) and Chaebol reform policies

5.5.1 Korean business groups (chaebols)

Schneider (2009) classified the origin of business groups into three categories: (a) *organic groups*, which emerge following the rationale of economics of scope and vertical integration; (b) *portfolio groups*, which emerge to diversify risk and maximize returns for corporate governance; (c) *policy-induced groups*, which emerge in response to government guidance. (These three explanations mostly copied the original sentences). The business groups in Korea, called *chaebols*, belong to the third category. Chaebols are the by-product of the state-led development policies established during the early development stage in Korea (Beck, 1998). Traditionally, the Korean government's export-oriented policy and the "Big Push" toward heavy manufacturing and chemical industries since the 1970s have favored large firms which can afford to be large-scaled and use up-front investment strategies (Kim, 2002). Concentration of national resources into a handful of large firms led Korea to astonishingly great

economic growth during the 1950s - 1980s (Beck, 1998; Krueger and Yoo, 2002).

As Beck (1998) points out, however, "success came at a price." As the economy developed, there was a growing realization that "such an unbalanced development strategy could ultimately hinder Korea's economic development" (Beck, 1998). For example, Chang and Park (2004) say that chaebols are considered by most authors to be characterized by low profitability, high financial leverage, abnormal ownership structure, peculiar modes of financing, excessive diversification, over-investment, and chronic abuses of power.[83] When we consider the strong dependency of the Korean economy on such a small handful of business groups, concerns about these problematic issues become intensified. For example, the top 30 chaebols accounted for more than half of all equity and sales in the private sector in 1996, immediately before the crisis (Beck, 1998).

The negative criticism of chaebols peaked when the financial crisis occurred in 1997. The crisis gave rise to a consensus about the necessity of chaebol restructuring, and the International Monetary Fund forced the Korean government to adopt new policies regarding chaebol, claiming the inefficient business practices of chaebols were one of the main culprits which caused the financial crisis. Since the 1997 financial crisis, the Korean government, supported by IMF and the World Bank, has tried to dismantle these unwieldy business groups, using a wide range of policies. However, even a decade later, the chaebols are more prosperous than ever, and are considered by many to have been to "saviors" of the Korean economy during the global economic crisis in the late 2000s (*The Economist*, March 31st, 2010). As Choo et al. (2009) said, after the Korean crisis, the surviving chaebols have been "reborn as attractive, profitable, and global players with very low debt ratios and very high foreign

[83]Among these characteristics, Chang and Park only consider excessive investment and abuse of power as real problems of chaebols.

shareholdings."

5.5.2 Government policies on restructuring of business groups

Policy makers argue that the main reason for government intervention to restructure Korean business groups was due to their nation-wide negative external effects, for the sovereign credit rating of the nation relies on the outcomes of such restructuring processes (Lee, 2004b). However, in Korea, historically, because of the failure to achieve a consensus about such needs, the efforts to reform business groups (*Chaebol reform*)) has not been successful (Beck, 1998).

The 1997 financial crisis finally brought about a national consensus on the need for the restructuring of business groups, for the IMF bailout agreement insisted upon corporate governance reforms and restructuring of business groups (Beck, 1998).

In order to revitalize the corporate sector, the Korean government suggested a "five plus three" approach: five initial reform plans plus three additional plans. Cherry (2005) provides the lists of the plans, as follows.

> [The initial five plans include] improved transparency in corporate governance, the abolition of cross-payment guarantees, the strengthening of corporate financial structures, a focus on core businesses, the promotion of cooperation with small- and medium-sized enterprises, and increased accountability of management and major shareholders. ... [The three additional plans include] a crackdown on the illegal transfer of wealth and inheritance tax evasion among members of the founding families, the prevention of illegal internal transactions and the curbing of chaebol control of financial institutions (Business Korea, 1999 ; Cherry, 2005).

Arguably the most visible reform for business groups was the business swaps

among them, the so called "Big Deals."[84] In order to resolve the accumulated over-capacity and over-investment in certain industries and to encourage business groups to re-focus on their core businesses, the Korean government promoted business swaps between large Korean business groups (Chang, 2006b). The "Big Deal" was attempted in nine industries that involved high capital intensity and fixed assets. These industries were semiconductors, petrochemicals, automobiles, aerospace, railway vehicles, power generation machinery, ship engines, oil refining, and electronics (Chang, 2006b).[85] This government-led industry-wide restructuring is generally considered to have been a great failure; as described in Table 7[86], only *ship engine* business showed modest profitability (Chang, 2003). In fact, the business groups were not interested in such business swaps in the first place, but only complied with the plan because of "fear of government reprisals" (Lee, 1998; Cherry, 2005). As Chang (2006b) notes, the problem was that it was political motives which led to the "Big Deal," rather than economic motives, and the government was much more interested in conspicuously visible (but largely superficial) outcomes rather than genuine restructuring.[87] In addition, a variety of analyses demonstrated the negative outcomes of the plan that the resulting mergers harmed fair market competition and worsened market concentration (Lee, 2004a).

Just as the government-driven restructuring program (the workout program) did not generate significant performance improvement (as described in the previous chapter), the business swaps induced by the government failed to result in successful outcomes. In a similar vein, many of the government reform policies did not achieve their initially expected results, and were sometimes only partially successful. For

[84] For a detailed description of "Big Deals," see Cherry (2005) and Lee (2004a).

[85] Lee (2004a) confirms that over-investment actually existed in the industries related to Big Deal.

[86] Source: Chang (2003), pp.207. The original source indicated by Change (2003) is, *The Chosun Ilbo,* 'Big Deal Became Empty Deal after Two Years', December 20, 2000.

[87] *The Chosun Ilbo,* 'Big Deal Became Empty Deal after Two Years', December 20, 2000.

Table 7: Big Deals among Korean business groups

Industry	Government's plan	Implemented as of December 1999	Results as of December 2000
Semiconductors	LG Semiconductor and Hyundai Electronics merge into one company.	Acquisition of LG Semiconductor by Hyundai Electronics was completed in July 1999.	Due to the lost synergies and the plunge of price of DRAMs, Hyundai Electronics is technically bankrupt; The government asked banks to buy bonds issued by Hyundai Electronics.
Pertrochemicals, aerospace	Affilites of Hyundai, Daewoo, Samsung merge into one company.	Aerospace businesses were combined into one in October 1999.	The merge company kept making losses; The government provided 530 billion won aids in 2000; Petrochemical deal did not go through.
Railroad vehicle	Hyundai, Daewoo, Hanjin merge their operations.	Hyundai, Daewoo, Hanjin merged their operations in October 1999.	Labor unions of three companies oppose the postmerger integration process; Overcapacity problem did not ease; The government is seeking a buyer.
Power generation machinery	Samsung and Hyundai sell their businesses to Korea Heavy Industries.	Korea Heavy Industries acquired Samsung and Hyundai's business.	Doosan, the 12th largest chaebol, acquired Korea Heavy Industries.
Ship engines	Samsung sells its busienss to Korea Heavy Industries.	Merged as planned.	Making a profit. Doosan acquired Korea Heavy Industries.
Petroleum refinery	Hyundai acquires Hanwha Refinery.	Hyundai acquired Hanwha Refinery in June 1999.	Postacquisition integration has yet to take place.
Automobile	Daewoo acquires Samsung Motors.	Deal did not go through.	
Electronics	Samsung acqruies Daewoo Electronics.	Deal did not go through.	

Source: Chosun Ilbo (December, 2000) ; Chang (2003), pp.207

example, although the debt-to-equity ratio initially *appeared* to be reduced to below 200% within two years, this reduction of the ratio was due only to an increase of equity rather than to a decrease of debt. The problem was that newly-issued equities were re-absorbed by the affiliate firms which operated under the same business group Lee (2004b). Under the new requirement of removing the it group chairman's offices (group-level staff organization),[88] business groups simply changed the name of this office to something such as the "strategic task force for business management," and relocated this organization to their flagship companies (Beck, 1998). Even with the requirement of 25 percent of directors being outside investors on the board of directors, most of outside directorships were simply filled by people who were already closely related to the dominant shareholders (Chang, 2006b).

Contrary to the government leading restructuring, the Korean government also came up with reforms which enhance the market mechanism. First, the government made easier the procedure of M&A and spin-offs to promote corporate restructuring. Second, the government made possible layoffs, which were practically impossible before the crisis. These two changes significantly affected the restructuring of business groups.

First, the rationalization of affiliates within a business group or reorganization of affiliate members across different groups had not commonly occurred before the crisis in Korea. Korean business groups rarely divested their affiliate firms before the crisis (Choe and Roehl, 2007), and relatively few mergers and acquisitions (M&A) had occurred in Korea before the crisis (Khanna and Palepu, 1999b). Indeed, because Korean business groups pursued size-oriented strategies, rather than performance-oriented strategies, the groups had avoided losing their affiliates by M&As (Beck,

[88]Through this chairman's office, the group chairman manages the core decisions over the entire group, such as "supervising the subsidiaries, managing the group's finances, choosing new investment projects, and making personnel decisions." (Beck, 1998).

1998), and avoided closing down their affiliates at all cost.[89] However, the new regulations enacted during the crisis promoted and streamlined the procedures of M&A, corporate spin-offs, small-scale mergers, and consolidation (Chang, 2004). This promotes the portfolio restructuring by business groups. As Choe and Roehl (2007) note, the business groups "usually attempted to use the economic crisis as an opportunity to exit from underperforming or loosely-coupled business, thereby strengthening their major businesses." In addition, the new regulations allowed hostile takeovers, (which were impossible before the crisis), and relaxed the ceilings on foreign ownership of Korean firms (Beck, 1998; Chang, 2004).[90]

Partly because business groups usually focused on size rather than performance, rationalization of business resources within an affiliate firm was not actively pursued before the crisis. For example, as Choo et al. (2009) demonstrated, an over-investment in capital resources was prevalent among business groups before the crisis. In addition, large-scale employment adjustments were historically difficult in Korea (Kim, 2002). Before the crisis, regulations which protected workers from being laid off prevented Korean firms from rationalizing their human resources. Strong labor unions in business groups made layoffs practically impossible, and thus they were expected to hold an excessive number of unnecessary employees before the crisis. However, after the crisis, in order to promote economic restructuring, the government legalized "redundancy layoffs" and allowed to use of "temporary work agencies" to enhance labor market flexibility (Kim, 2002)). This helped business groups in restructuring and rationalizing their affiliate firms.

[89]Before the 1997 crisis, the Korean government also had protected firms from closing down, and had periodically ordered business groups to take over failing firms (Beck, 1998).

[90]Hostile takeovers were impossible before the crisis, partly because obtaining more than 10% of a firm's listed stock required a report to the stock exchange (Beck, 1998). However, because affiliate network of groups were protected by high cross-ownership (Chang, 2004), even after the crisis, hostile M&As remain rare in Korea.

Under these market environmental changes, a business group could effectively exert its portfolio restructuring with three possible responses: (a) the rationalizing of each of its affiliates; (b) the reorganization of its affiliate portfolio (acquiring new affiliates or selling off low-performing affiliates); (c) the reallocation of resources among its affiliates. In Korea, before the crisis, these restructuring activities were seldom used by business groups, but the 1997 financial crisis promoted such activities.

5.6 Empirical Method: Decomposition of Productivity Growth

This study utilizes a decomposition method of productivity growth in order to investigate the sources of the group level productivity change. Previous research analyzing the connection between micro level productivity (establishment or firm level) and aggregate productivity has utilized various ways of decomposing productivity growth.[91] One set of the productivity decomposition methods is a method which keeps track of changes of each individual firm. This decomposition method was first introduced by Baily, Hulten, and Campbell (1992), and has been further refined by recent studies such as Griliches and Regev (1995), Foster, Haltiwanger, and Krizan (2001), and Brown and Earle (2008).[92] Specifically, this method keeps track of individual firms from one period to the next period in terms of changes in their market shares and their productivity (except for entrants and exitors, whose productivity is only observed in one period) (Melitz and Planec, 2012).[93] However, this method suffers from

[91]See Foster, Haltiwanger, and Krizan (2001), Melitz and Planec (2012), and Devine et al. (2012) for reviews of the decomposition methods of productivity growth.

[92]For example, Hallward-Driemeier and Rijkers (2011) used this decomposition method to investigate the creative destruction effect during a financial crisis.

[93]For example, the most recently revised method by Brown and Earl (2008) decomposes the productivity growth of the economy into: (1) the effect of incumbents' productivity change (*within effect*), (2) the effect of incumbents' market share change (*between effect*), (3) the interaction effect between productivity change and market share change of incumbents (*cross effect*), (4) the effect

biases (Melitz and Planec, 2012). Another set of decomposition methods decomposes the increases in aggregate productivity into: (a) the effect of a resource reallocation towards more productive firms, and (b) the effect of increases in average productivity growth. This method was first introduced by Olley and Pakes (1996), hereafter referred to as the OP method. It was used investigate allocative efficiency, and was further refined by Melitz and Polanec (2012) to take into account the effects of entry and exit. This present paper draws upon the OP decomposition method, as refined by Melitz and Planec (2012), to investigate how the portfolio change in affiliate network and the change in allocative efficiency among affiliate members contribute to the overall group level productivity. To begin with, the productivity of the entire economy (P_t) can be measured by a weighted average of firm level productivity (P_{it}), with share of sales (S_{it}) as weights.

$$P_t = \frac{1}{n}\sum_{i}^{n} S_{it}P_{it} \tag{17}$$

Where P_{it} is firm i's productivity at time t, and S_{it} is firm i's share of output at time t.

OP method decomposes this "weighted average of productivity of firms (P_t)" into the "unweighted average of productivity of firms ($\overline{P}_t$)" and the "covariance between market shares and firm level productivity ($cov(S_{it}, P_{it})$)." The greater this covariance, the higher share of output goes to more productive firms and the higher is the productivity of the entire economy.

$$P_t = \overline{P}_t + \sum_{i}^{n}(S_{it} - \overline{S}_t)(P_{it} - \overline{P}_t) = \overline{P}_t + cov(S_{it}, P_{it}) \tag{18}$$

of productivity difference between entrants and incumbents (*disproportionate entry effect*), (5) the effect of market share difference between entrants and incumbents (*proportionate entry effect*), and (6) the effect of removing firms out of membership (*exit effect*).

Where $P_t = \frac{1}{n}\sum_i^n S_{it}P_{it}$ is a weighted average of firm level productivity (P_{it}) in time t, shares of sales as weights; $\overline{P}_t = \frac{1}{n}\sum_i^n P_{it}$ is an unweighted mean productivity in time t; and $\overline{S}_t = \frac{1}{n}\sum_i^n S_{it}$ is an unweighted mean share in time t.

Melitz and Planec (2012) further refine the cross-sectional and static OP method to take into account 'entry' and 'exit' effects (*hereafter* Dynamic OP method). Dynamic OP method decomposes the change in aggregate weighted average of firms into three groups: survivors, entrants, and exitors. As in OP method, the productivity contribution by survivors is decomposed into the change in (1) the 'aggregate unweighted average of productivity among survivors' and (2) the 'change in the covariance between market shares and productivity among survivors'. For the effect of entry and exit, their productivity is compared with survivors' productivity.

Between Period $(t-1)$ and Period (t), for example,[94]

$$\Delta P_{(t)} = \Delta\overline{P}_{co,(t)} + \Delta cov_{co,(t)} + S_{en,(t)}(P_{en,(t)} - P_{co,(t)}) + S_{ex,(t-1)}(P_{co,(t-1)} - P_{ex,(t-1)}) \quad (19)$$

Where $\Delta P_{(t)} = (P_{(t)} - P_{(t-1)})$ is a change in aggregate productivity from Period $(t-1)$ to Period (t); $\Delta\overline{P}_{co,(t)} = \overline{P}_{co,(t)} - \overline{P}_{co,(t-1)}$ is a change of average productivity of continuing firms; and $\Delta cov_{co,(t)} = \sum_{i\in co}[(S_{i,(t)} - \overline{S}_{(t)})(P_{i,(t)} - \overline{P}_{(t)}) - (S_{i,(t-1)} - \overline{S}_{(t-1)})(P_{i,(t-1)} - \overline{P}_{(t-1)})]$ is a covariance between the change in share and the change in productivity for continuing firms.

In Equation (19), subscripts indicate the types of firm groups: '*co*' for continuing firms; '*en*' for entrants; '*ex*' for exiting firms. This equation is composed of four additive terms. The first term ($\Delta\overline{P}_{co,(t)}$) is productivity improvement of continuing firms, and positive value indicates that average of productivity of continuing firms

[94]This example of Dynamic OP method follows the description in Devine, Doan, Lyer, Mok, and Stevens (2012).

increase over time (from Period $(t-1)$ to Period (t)). The second term ($\Delta cov_{co,(t)}$) is productivity improvement due to reallocation, and positive reallocation effect indicates that business activities of more productive firms grow, and thus contributes positively to aggregate productivity. The third term ($S_{en,(t)}(P_{en,(t)} - P_{co,(t)})$) is the entry effect, and positive value indicates the average productivity of entrants is greater than that of the continuing firms when they enter in Period t. The fourth term ($S_{ex,(t-1)}(P_{co,(t-1)} - P_{ex,(t-1)})$) is the exit effect, and positive value indicates that the average productivity of exiting firms is lower than that of continuing firms in Period $(t-1)$, and thus their exiting in Period t contributes to the increase in the aggregate productivity (exiting firms do not operate business and disappear in Period t).

5.7 Data Sources and Measurements

5.7.1 Data Sources

Several sources of database are used in this study. First, list of firms belong to business groups are based on the information provided by the *Korean Fair Trade Commission* (KFTC). The financial information on both business groups and non-group firms was mainly based on KIS-VALUE data and KIS-LINE database, both of which are created by the Korea Investors Service (KIS). [95] In addition, some of missing data points were complemented by the database compiled by the *Korea Listed Companies Association* (KLCA), which contains information on listed firms.[96]

This study restricts analyses on financial data on the sample of the manufactur-

[95]The KIS database covers both the listed firms and unlisted firms subject to an external audit. In Korea, firms greater than a certain size are subject to external audit. This criterion has been changed several times. For example, under the regulations which took effect in 2009, firms with assets greater than 10 billion won (approximately $10 million) are subject to an external audit in Korea. The sample in the KIS-VALUE database only includes firms that were in business as of the end of 2009.

[96]KLCA dataset contains financial information during the period for which firms maintain their status as listed firms and audit firms.

ing sector, because the nature of non-manufacturing sectors is quite different from the manufacturing sector. The sample period for analyses is restricted to be from 1992 to 2004. [97] The sample further excludes the firms whose industry information changes between the manufacturing sector and the non-manufacturing sectors during the sample period in order to prevent any potential spurious effect.

5.7.2 Measurements

This paper focuses on the labor productivity as a productivity measure. Labor productivity is defined as real value added divided by the number of employees. To measure the aggregate group level productivity of each business group, this study applies the way of measuring the aggregate productivity across industries (e.g. Olley and Pakes, 1996). Specifically, we construct the group productivity of each business group as a sales weighted average of the productivities of all affiliates within a group. The basic idea of this measure is that the contribution of each firm's productivity to the aggregate productivity is magnified by its output size. In other words, productivity of affiliates with bigger sales will account greater portion for their aggregate group productivity than other smaller affiliates. To take into account the difference across industries, this study uses the *relative* productivity to the industry median.[98] Specifically, the relative productivity is calculated by a firm's productivity subtracted by the industry median and divided by the industry median.[99]

[97] The sample is restricted to data beginning in 1992, because the business environment radically changed during the late 1980s in Korea. The sample is restricted to events occurring prior to 2005, to avoid the effects of the global recession in 2006.

[98] Alternatively, the relative productivity can be calculated compared to the industry mean. During a crisis, however, a few outliers (especially show extremely low productivity) can extremely affect the relative measure to the mean. Therefore, we take relative productivity to the median productivity to avoid such bias.

[99] The industry median is calculated using all the firms in the sample, including non-group independent firms. Therefore the measure of the relative productivity of business groups is compared to all their industry rivals, not just compared to their revival business groups. In our sample, the industry median values are all positive, and thus they could be used as denominator without further

The exiting times are corrected to be earlier than actual ones if the firms are practically bankrupt or cannot be considered to be in normal operation; this is the case, for instance, when the number of employees of firms suddenly decrease to unreasonable numbers and then the firm exit in a few of years; when firms stop report financial information and then exit in a few years. For example, *Kapul* reported its value-added information only until 2003, and it disclosed and disappeared from the sample soon after. *Daewoo Electronics* reported its employees as 4300 in 2003, but its employees suddenly dropped to only two people in 2004. It eventually disclosed later. Therefore it is considered to have exited in 2004. *Hanil Textile*'s number of employees dropped from 864 in 2003 to 19 in 2004, and disclosed later. Hanil Textile is considered to have exited in 2004. Haepyo Food reported its number of employee as 150 in 2001, did not report in 2002, and reported zero in 2003. Haepyo Food is considered to have exited in 2002. [100]

5.8 Empirical Analyses and Results

5.8.1 Group level bankruptcy

During the 1997 Korean financial crisis, the prevalent myth of "too big to fail" broke down. In fact, thirteen of top thirty business groups experienced workouts or bankruptcy during the crisis. Table 8 shows the results of simple logistic regressions using group level data. The available data for this analysis is group level measures and the measures include both manufacturing and non-manufacturing sectors. Due to data availability at the group level, the labor productivity is constructed by the total sum of value added divided by the total sum of employees of all affiliates within

modification.

[100]In general, if the number of employee drops by more than 60% and also the firm exit within several years, the firms were considered to exit the point in which their employees substantially drops.

a group. In addition, profitability is measured by the total sum of profits of affiliates divided by the total sum of sales of affiliates within a group. Models (1) through (4) in Table 8 use covariates in 1996 to predict the bankruptcy after 1997, while models (5) through (8) use average value of covariates from 1994 to 1996.

These simple logistic regressions based on crude measures with limited observations of thirty business groups show consistent results with Choi (2010). Specifically, the results indicate that business groups who had high debt-to-equity ratio and low performance suffer from higher probability of bankruptcy during the financial crisis. Choi (2010) uses profitability as a performance measure, and does not consider productivity measures. Interestingly, the results of the current analyses show that the probability of bankruptcy appears to be more related to the productivity, compared to the profitability.

5.8.2 Results of Productivity Decomposition

To investigate the decomposed effect of productivity change, business groups are divided into two groups according to asset size in 1996: the first group contains those ranked in the top five, while the *6th-30th group* contains the rest (ranked 6th through 30th groups). Table 9 displays the decomposition results for the two split categories. The time range was split into three periods: the pre-crisis period (1993-1996) compares the productivity between 1992 and 1996; the crisis period (1997-1999) compares between 1996 and 1999; and the post-crisis period (2000-2004) compares between 1999 and 2004. For example, the *entry effect* of the crisis period is based on the entrants into a business group between 1997 and 1999, while the *exit effect* of the period is based on the affiliates exiting from a group between 1997 and 1999; the *average productivity improvement of affiliates* and the improvement in *allocative*

Table 8: Logit Analysis for Group-level Bankruptcy

Dep. Var. = I (group bakruptcy = 1)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Debt-to-equity ratio('96)	14.57*	16.24*	15.74*	20.66*				
	(8.832)	(8.309)	(9.277)	(12.48)				
Labor productivity('96)	-17.29*		-19.76*	-18.38*				
	(9.242)		(10.75)	(11.09)				
Profitability('96)		-7.436	11.94	13.36				
		(19.10)	(22.92)	(24.06)				
Asset('96)				0.000597				
				(0.000820)				
Liabilities('96)				-0.000785				
				(0.00106)				
Debt-to-equity ratio('94-'96 average)					14.13	14.78*	18.58	27.35*
					(9.419)	(8.550)	(11.65)	(15.02)
Labor productivity('94-'96 average)					-21.19**		-27.53**	-27.63**
					(9.786)		(13.18)	(13.38)
Profitability('94-'96 average)						-22.72	30.59	32.76
						(26.96)	(37.41)	(41.96)
Asset('94-'96 average)								0.00121
								(0.00102)
Liabilities('94-'96 average)								-0.00158
								(0.00134)
Constant	-8.745	-13.58**	-9.131	-13.03	-7.118	-12.26*	-9.291	-15.92
	(7.451)	(6.764)	(7.596)	(10.09)	(7.896)	(6.916)	(8.669)	(11.15)
Observations	30	30	30	30	30	30	30	30

efficiency are based on the affiliates that appear in both 1996 and 1999.[101]

In the pre-crisis period (1993-1996), most decomposed effects are positive for both the top-five. The growth of group productivity in the top-five group (49.312) was greater than the growth of the *6th-30th group* (31.053). Although the group productivity and *affiliate average productivity* of the 6th-25th group increased according to absolute productivity, both the group productivity (-0.141) and the *affiliate average productivity* (-0.330) measured by relative productivity decreased in the pre-crisis period. This indicates that, although those in the *6th-30th group* improved their productivity, the improvement was not greater than their industry rivals. The improvement in the *allocative efficiency* of the top-five group (10.806) was lower than in the *6th-30th group* (17.099), but the measure of relative productivity produces the opposite results (0.267 for the top-five group and 0.147 for the other group). This means that the growing affiliates in the top-five group were high performing within their groups, and their performance becomes more outstanding if it is compared to their industry rivals. This may indicate that the top-five group focuses more on businesses in which they outperform. Both groups display a positive *entry effect*, indicating that they acquired or launched new businesses that were more productive than the affiliate average. The relatively small *exit effect* in the pre-crisis period appears to reflect the *exit effect* during the crisis. It is worth noting that the *exit effect* in any period can reflect the *exit effect* in the later periods, because exiting firms may fail to provide their financial information and thus disappear out of the sample well before their actual exit. In fact, the *exit effect* realized in the pre-crisis period is very likely to be the effect attributable to the crisis period.

[101]The continuing affiliates may disappear between the two periods in this analysis. In the crisis period (1997-1999), for example, the continuing firms are defined as the firms that appear in 1996 and 1999, but it is possible that they may disappear (for whatever reason) between 1997 and 1998 in the sample.

Table 9: Average decomposed effects between the top five vs. the remaining groups

	Group type	Periods	Change in group productivity	DECOMPOSITION Change in affiliate average	Change in allocative efficiency	Entry effect	Exit effect
Labor	Top 5	92 to 96	49.312	18.021	10.807	21.459	-0.974
Productivity	The rest	92 to 96	31.053	6.283	17.099	7.282	0.390
(absolute value)							
	Top 5	97 to 99	41.633	52.924	-25.132	3.435	10.406
	The rest	97 to 99	11.365	28.642	17.612	-2.128	-32.760
	Top 5	00 to 04	11.856	40.773	-7.126	-39.817	18.026
	The rest	00 to 04	-36.187	-17.411	-8.776	-10.956	0.956
			Group productivity	Affiliate average	Allocative efficiency	Entry effect	Exit effect
Labor	Top 5	92 to 96	0.367	0.088	0.267	0.061	-0.048
Productivity	The rest	92 to 96	-0.141	-0.330	0.147	0.037	0.005
(relative to median)							
	Top 5	97 to 99	0.743	0.833	-0.191	0.005	0.096
	The rest	97 to 99	0.241	0.190	0.144	-0.031	-0.062
	Top 5	00 to 04	0.645	0.414	0.597	-0.333	-0.032
	The rest	00 to 04	-0.451	-0.227	-0.123	-0.002	-0.099

In the crisis period (1997-1999), both the top-five group and the *6th-30th group* effectively increased their *affiliate average productivity*.[102] The other decomposed effects are quite different between the two groups. The *allocative efficiency* of the top-five group decreased during the crisis, indicating that affiliates that grew more were not necessarily higher performers. In contrast, the positive effect of the *allocative efficiency* of the *6th-30th group* indicates that higher performers grew faster than lower ones. The positive *entry effect* in the top-five group and the negative *entry effect* in the *6th-30th group* demonstrate that the highly productive new businesses joined the top-five group, while entrants into the *6th-30th group* were low performers. Some business groups in the *6th-30th group* actually tried to expand during the crisis by acquiring poorly performing bankrupt firms, which worsened the situation of the acquirer in the post-crisis period. The top-five group effectively removed low performers within the group (the positive *exit effect* measured by absolute productivity), which were also low performers in their industries (the positive *exit effect* measured by relative productivity). The *6th-30th group*

The analysis further splits business groups into (a) survivors, (b) temporary survivors, and (c) failures (immediate failures). The *survivor group* contains business groups that survived long after the financial crisis. The *temporary survivor group* contains business groups that temporarily survived during the crisis-period, but eventually failed and disappeared by year 2005. Finally, the *failure group* contains business groups that immediately disappeared during the crisis-period. Table 10 display the decomposed effects in productivity change among the three groups. The decomposed effects in the productivity change are averaged within each group (survivors,

[102]This can reflect either successful restructuring outcomes or merely a short-term productivity boost at the expense of long-term health. In fact, while the top-five group maintained improvement in the *affiliate average productivity* in the post-crisis period, the *6th-30th group* experienced a decrease in the *affiliate average productivity*.

temporary survivors, and immediate failures). The analyses used two productivity measures: (a) (absolute) productivity and (b) relative productivity (compared to the industry median). Two measures provide consistent results, and the interpretation of the results will be based mainly on the productivity.

In the pre-crisis period (1993 - 1996), the *survivor group* shows greater improvement in *group productivity* (55.614) than the other two groups. More than half of this improvement is due to the increase in *average productivity of affiliates* (30.049). The *entry effect* (14.354) also accounts for significant portion of increase in group productivity. The positive effect of *allocative efficiency* indicates that higher performers within a business group grew faster than lower performers, positively contributing to the group productivity. Modest but positive *exit effect* indicates that relatively lower performers exited their group, improving the group productivity. It is worth noting that the *exit effect* in any period can reflect the *exit effect* in the later periods, because exiting firms may fail to provide their financial information and thus disappear out of the sample well before their actual exit. In fact, the *exit effect* realized in the pre-crisis period is very likely to be the effect attributable to the crisis period.

In the crisis period (1997 - 1999), the *survivor group* achieved great improvement in the *group productivity* (64.286). Most of the improvement is due to the increase in *affiliate average productivity* (52.455), implying successful restructuring outcomes during the crisis. The productivity gain from *allocative efficiency* (21.626) is also significantly increased from that in the pre-crisis period. In other words, the higher performing affilaites grew faster than lower performers during the crisis, and their productivity came to contribute more to the group productivity. Negative *entry effect* implies that the productivity of newly entering affiliates is lower than that of existing affiliates. This may suggest that the *survivor group* might have selected acquisition targets which showed currently depressed performance but had higher

Table 10: Average decomposed effects between the surviving vs. failing groups

	Periods	Group type	Change in group productivity	DECOMPOSITION Affiliate average	Allocative efficiency	Entry effect	Exit effect
Labor	93 - 96	Survivors	55.614	30.048	9.807	14.354	1.404
Productivity		Temporary survivors	12.031	24.062	-16.020	5.862	-1.873
(absolute value)		Failures	-7.467	-66.086	60.114	0.242	-1.736
	97 - 99	Survivors	64.286	52.455	21.626	-2.913	-6.883
		Temporary survivors	-9.633	8.558	29.183	-0.942	-46.432
		Failures	-95.857	-1.858	-39.025	3.740	-58.715
	00-04	Survivors	8.052	29.095	-9.410	-19.576	7.944
		Temporary survivors	-176.164	-156.876	-4.431	-3.185	-11.672
Labor	93 - 96	Survivors	0.355	0.124	0.087	0.123	0.021
Productivity		Temporary survivors	0.258	0.276	-0.086	0.125	-0.057
(relative to median)		Failures	-1.455	-1.774	0.614	-0.263	-0.032
	97 - 99	Survivors	1.055	0.821	0.272	-0.049	0.010
		Temporary survivors	0.918	0.073	0.714	-0.020	0.150
		Failures	-2.209	-0.965	-0.973	0.040	-0.311
	00-04	Survivors	0.253	0.254	0.043	-0.069	0.026
		Temporary survivors	-2.349	-1.632	-0.108	-0.047	-0.562

long term potential. The negative *exit effect* implies that some affiliates that exited during the crisis had previously been apparently higher performers before the crisis (at 1996). If such firms could have continued to outperform had the crisis not occurred, their exit would have incurred big loss to a group. Alternatively, their exit may be desirable to a group from the long term perspective. The effects of entry and exit are small, compared to the other effects.

After the crisis (2000 - 2004), the growth of *group productivity* by the *survivor group* (8.052) slowed down. The *average productivity of affiliates* was still improved, while *allocative efficiency* decreased. Once the *allocative efficiency* (-9.410) was measured using the relative productivity, the negative effect was critically reduced (-0.043). This may indicate that the affiliates which grew relatively more than other affiliate members were in relatively lower performing industries. In this period, the *survivor group* show relatively high negative *entry effect*. This may indicate that the surviving business groups that re-focused their business portfolio during the crisis may have started to expand again once the crisis ended. Overall, the *survivor group* achieved substantial productivity enhancement during the crisis by reorganizing their business portfolio and restructuring their affiliates during the financial crisis.

The *temporary survivor group* experienced moderate increase in the *group productivity* before the crisis, but the productivity continued to decrease until they finally disappeared. In the pre-crisis period, the improvement in *affiliate average productivity* (24.062) of the *temporary survivor group* was close to that of the survivor group (30.048). Once the effect is measured by the relative productivity, the improvement of average affiliate productivity by the *temporary survivor group* (0.276) more than doubles that by the survivor group (0.124). This may indicate that the business groups in the *temporary survivor group* operate their businesses usually in lower performing industries than the industries in which the survivor group operates. During

the crisis, however, the improvement of average affiliate productivity was only moderate compared both (a) to the improvement before the crisis and (b) to the survivor group. The failure of significant improvement of such average productivity is followed by substantial decrease productivity after the crisis, leading this group to eventually disappear from the economy.

The effect of *allocative efficiency* was negative before the crisis (-16.020), indicating that lower performing affiliates are growing while higher performing affiliates are shrinking. The *allocative efficiency* improved during the crisis (29.1831), but decreased again after the crisis (-4.430). The *entry effect* was positive before the crisis (0.24) but turned negative during and after the crisis (-0.942 and -3.185, respectively). This may indicate that desire of expansion acquiring low performing businesses during the crisis worsened the overall group performance. The *exit effect* during the crisis was significant (-46.4323), indicating that exiting affiliates during the crisis had previously been higher performers before the crisis. Interestingly, the *exit effect* based on the measure of relative productivity was positive (0.150). This may indicate that the groups focused on the industries in which they outperform. During the crisis, the *temporary survivor group* only improved *allocative efficiency*, failed to effectively improve the *average productivity of their affiliates*, acquired low performing businesses, and discard affiliates whose productivity were lower than their industry rivals. In the post-crisis period, all the decomposed effects of the *temporary survivor group* are negative.

Finally, the *failure group* shows low performance even before crisis occurred, and they disappeared during the crisis. In the pre-crisis period (1993 - 1996), both the *group productivity* (-7.467) and the *affiliate average productivity* (-66.09) are negative. The group shows the high positive effect of the *allocative efficiency* (60.114). While affiliates productivities are decreasing on average, the group offset such negative effects

by growing higher performers. The *entry effect* measured by absolute productivity is positive, while that measured by relative productivity is negative. Therefore, the entrants are lower performers in their industries, although they are higher performers within the group. The modest *exit effect* seems to be attributable to the effect in the crisis period.

In the crisis period, (1997 - 1999), the performance of the *failure group* was exacerbated. The *average productivity of affiliates* still decreased (although slightly), and the effect of *allocative efficiency* turned to negative. Although higher performers newly joined the *failure group*, the *entry effect* was modest. In contrast, the *exit effect* is substantially negative, as the *failure group* lost affiliates that had previously been higher performers (at least) before the crisis. Finally, the negative effect of *allocative efficiency* indicates that higher performers within the group lost more sales than lower performers. The *failure group* disappeared during the crisis.

5.9 Discussion and Conclusion

Whenever dramatic changes have occurred in the "economic, technological, social, and political" environment, firms have struggled to adapt (Deal, 1985; Kimberly and Quinn, 1984; Gersick, 1991). It is their responses to such environmental changes that determines which firms will survive, which will get stronger, and which will disappear. A financial crisis is widely acknowledged to cause an intensely negative shock to the economy, to bring about environmental changes, and to induce a wide range of restructuring activities in the economy.

At least in theory, a financial crisis can provide not only severe threats but also rare and valuable opportunities for business groups in their business portfolio restructuring. First, a crisis can dismantle unproductive business groups, and redistribute

their resources to other more productive firms (or to other groups). Business groups can improve their overall group productivity by acquiring productive firms whose asset values, (and therefore their purchase price) may be artificially depressed during the crisis. Secondly, business groups can discard their low-performing affiliates, which is not necessarily possible before a crisis. Low-performing affiliates can be sold off, internally-merged, or shut down entirely. Finally, business groups can further improve their overall group level productivity by enhancing allocative efficiency among their affiliates. In summary, a financial crisis can provide business groups the opportunity to effectively improve their overall group level productivity through the restructuring of their affiliate portfolio.

The realization of such desirable outcomes of portfolio restructuring would rely on aforementioned four distinct types of restructuring activities; namely, improvement of the productivity of individual affiliates, the increase of allocative efficiency, and the quality of their acquisition and divestiture decisions. Therefore, if we could closely examine the procedures and investigate how each activity of portfolio restructuring contributes to the group productivity, it will extend our understanding of portfolio restructuring. However, the literature has suffered from a lack of systematic tools for doing this. By viewing each business group as an individual economic ecosystem, the current study claims that the method of productivity decomposition provides useful framework for decomposing the change of group productivity into four distinct types of portfolio restructuring activity. This study contributes to the literature by suggesting that this productivity decomposition method can be an effective tool for investigating the performance of portfolio restructuring. With empirical analyses, the current study further contributes to the literature on how business groups respond to a financial crisis in terms of their business portfolio restructuring. Specifically, this study investigates how each activity of portfolio restructuring contributes to

the productivity changes of business groups during the 1997 financial crisis in South Korea.

The results of this study reveal the usefulness of the method of productivity decomposition. In general, the results imply that the stronger business entities get even stronger during a financial crisis. Most of the top five business groups, which had the greatest dominance in the Korean economy, appear to have successfully taken advantage of the rare opportunities offered by the financial crisis, have developed more productive business portfolios, and have increased their dominance and influence (except for the Daewoo group). During the crisis, the top five groups effectively increased their affiliate average productivity, embraced highly productive new businesses, and removed low-performing firms. These groups have continued to maintain the improvement of affiliate average productivity after the crisis, while they have divested themselves of their low- performing affiliates. The remaining groups (6th - 30th), have also succeeded in increasing the average productivity of their affiliates during the crisis, but they could not maintain such productivity improvement once the crisis ended. Some of their affiliates that had been highly productive *before* the crisis were unable to survive the crisis, and thus damaged the overall productivity of their groups. Comparing the decomposed effects between the surviving business groups and the failing groups provides further useful insights. Bankrupt groups that immediately disappeared shortly after the crisis began reveal that their affiliate average productivity had already decreased *before* the crisis occurred. During the crisis, they lost some of their previously high-performing affiliates (which began to fail during the crisis), and they were unable to create growth in the other higher-performing affiliates which they retained. Other failing groups were the ones which managed to *temporarily* survive throughout the early years if the crisis, but eventually disappeared after 2004. Their improvement of affiliate average productivity was higher in

the pre-crisis period than in the crisis period, which indicates that their restructuring of their individual affiliates was not successful during the crisis. Just as with the immediately-exiting groups, during the crisis, these later-failing groups suffered the loss of their previously high-performing affiliates. Their improvement of group productivity came primarily from improving allocative efficiency, and real improvement in the productivity of individual affiliates was marginal. Finally, it was the surviving groups which were the ones that benefitted the most during the crisis. Their greatest productivity gains were a result of their successful improvement of the productivity of their individual affiliates, and their increased allocative efficiency. Although they also lost *some* of their high-performing affiliates and tried to acquire low-performing affiliates, the negative effects were very marginal. In general, the financial crisis appeared to have provided more opportunities to the strong groups, and to have created more threats to weaker groups.

While this analysis provides useful insights into how each activity of portfolio restructuring affects the composite group productivity, it also has limitations. First, this analysis was based only upon the Korean situation. Because the forms of business groups vary widely across countries, further study using other countries and their business groups will probably reveal a broader perspective on this subject, Secondly, due to limitations of the availability of data, the business groups analyzed in this study were restricted to only about 30 of the largest groups that went through the crisis. Although, due to purposes related to more effective monitoring and management, the Korean government restricts the list of business groups only to these 30 or so very large groups, there also exist many smaller (and less diversified) business groups which are similar in their network features to the large groups. Future studies on those smaller business groups could potentially yield more detailed information. Finally, this research considered the labor productivity as the only measure of productivity.

Alternatively, productivity could be measured as total factor productivity (TFP), which considers both labor and capital resources. However, the chaotic period of a crisis is not the best type of period in terms of the regular assumptions which are required to estimate standard TFP, and thus this study refrained from attempting to estimate TFP. We hope future research will be done which will complement such measurement issues, and extend our understanding on the subject. Even with its current limitations, I believe that the productivity decomposition method has more promise for related future research than this study was able to fully utilize. I hope that the limitations of this study will eventually inspire and motivate further research in the future.

6 CONCLUSION OF DISSERTATION

This dissertation investigates the effects of a financial crisis on the productivity of firms. Chapter 1 provided the overview of the dissertation. Chapter 2 reviewed conceptual effects of a financial crisis on the productivity of firms. Crises can purge the economic system of inefficient elements, and therefore, by doing so, can ultimately improve the efficiency of the economy. This "cleansing effect" (Caballero and Hammour, 1994) supposedly frees up the resources held by less efficient firms and makes them available to more efficient firms. Furthermore, the "Pit-stop view" (Aghion and Saint-Paul, 1991) provides useful insight into resource allocation activities within surviving firms during a crisis. Under the low demand conditions which prevail during a crisis, firms will reduce their production activities, and devote their efforts and resources to activities that will enhance their productivity. In actual financial crises, there are other influences that may affect the cleansing process. During a financial crisis, banks usually have their own liquidity problems, and may continue allocating resources to loss-generating firms in order to help them survive. Banks will often do this because they fear the bankruptcy of such firms could lead to the failure of the banks themselves. Furthermore, government interventions can distort the cleansing effect of the crises. To avoid a possible economic collapse, the government may support firms regardless of their performance. Finally, in emerging countries, there usually exist business groups that have substantial size and power. Investigation of productivity dynamics within business groups will further offer insight into the dynamics of productivity during a financial crisis. Drawing upon the data on the 1997 Korean financial crisis, the three following chapters empirically study (a) the effect of a financial crisis on the dispersion of firms, (b) the effect of government sponsored

corporate restructuring during a financial crisis, (c) The effect of business portfolio restructuring by business groups on their productivity during a financial crisis.

The empirical studies included in this dissertation began by investigating the effect of a financial crisis on the overall productivity of the whole manufacturing sector. While literature has frequently examined the productivity change (growth) during a financial crisis, it has not paid much attention to the change in productivity dispersion during a crisis. However, studying the dispersion of productivity provides important insights into the effect of a financial crisis on the overall efficiency of the economy.

Chapter 3 contributes to the literature by analyzing the change in productivity variation due to a financial crisis. Specifically, it is the first study to compare the productivity variation between the pre- and post-crisis periods and to apply econometric methods to statistically test the change in this variation. Drawing upon the multi-level model, this study finds that there was a statistically-significant change in productivity dispersion during the 1997 Korean financial crisis. The variance of productivity was decomposed at the inter- and intra-industry levels. The results show that, after the financial crisis, the dispersion of productivity increased among firms within the same industries, while the dispersion of industry average productivity did not increase. The results appear to indicate that financial crises affect different firms in different ways. Subsequent chapters further investigate the productivity dynamics which occur during a financial crisis.

A financial crisis can cause financial distress to all types of firms, regardless of their future prospects. A cleansing effect may select out firms based merely on their short-term financial distress, increasing the risk of an economic collapse. Corporate restructuring was recognized as a key to the recovery (Claessens, 2005), and governments often feel they have no choice but to lead the restructuring process of the firms

of their nation. During a systemic financial crisis in which a great number of firms simultaneously experience severe financial distress, an out-of-court, voluntary debt-restructuring process can be the only option (Mako, 2002). Such so-called "workouts" are considered "less time-consuming, less costly, and more rapid" (Lee, 2011), and therefore such an approach was adopted by many countries during the 1997 Asian crisis, including Korea. A small amount of previous literature shows the weakness of trying to infer a causal effect using observational data on workouts. The main challenge in such a study is to organize an appropriate control group for comparison with the treated group (the firms which participated in the workout program) that avoids selection bias of non-random assignment.

Chapter 4 contributes to the literature by executing more rigorous analyses on the effect of the workout program on the productivity of participants. To achieve the best matches between the treated and the control in multi-dimensional covariates, Chapter 4 draws upon the genetic matching method. The genetic matching method uses a genetic algorithm that iteratively checks and improves covariate balance, achieving to provide the most desirable matched samples. The results show that the effect of the workout program on the productivity improvement of the participant firms during the Korean crisis was not statistically significant. This indicates that, although the workout program *may* have been helpful in other respects, it was *not* effective for improving the productivity of participant firms. This conclusion highlights the fact that the government-driven restructuring process and reforms during a financial crisis may not be significantly effective in many cases.

In addition to enforcing the government-driven efforts, a financial crisis can also promote market mechanisms, generating both opportunities and threats for firms in the economy.[103] In fact, a financial crisis can provide some rare opportunities, espe-

[103]In fact, governments often abandon market regulations and rely on market-driven reforms during

cially to a business group (an entity composed of affiliate firms) in restructuring and developing its business portfolio. A crisis will punish the ineffectively-managed firms or groups, and make their assets and established businesses available to new owners, who may be able extract more value and productivity out of them.[104] In addition to stimulating intense restructuring activities, a crisis also offers legitimate excuse for a group to discard low-performing businesses. Therefore, an interesting question concerns how business groups can improve their productivity by portfolio restructuring, whose process involves four separate activities such as (a) improving the productivity of their individual affiliates, (b) increasing their allocative efficiency, (c) improving the quality of their acquisition, and (d) enhancing the benefits from divestiture. However, the literature has suffered from the lack of a systematic framework which would allow researchers to simultaneously investigate such distinct activities of portfolio restructuring.

Chapter 5 contributes to the literature by applying the productivity method for analyzing the performance of portfolio restructuring. Specifically, it investigated how each of such four activities of portfolio restructuring contributed to the productivity change of business groups during the 1997 financial crisis in South Korea. The method neatly decomposed the change of group productivity into four distinct activities of portfolio restructuring. The results generally implied that the stronger entities get even stronger during a financial crisis. During the crisis, most of the top five business groups successfully improved the average productivity of their affiliates, acquired higher-performing affiliates, and discarded low- performing affiliates. Most of the productivity gains of surviving groups during the crisis came from the increased productivity of affiliates and improved allocative efficiency. Although some of them

a crisis.

[104]For example, they can be more efficiently operated, or they can generate more synergy effects in other business groups.

tried to acquire low-performing firms (perhaps those they believed had high future potential) and lost affiliates that had previously been highly productive before the crisis, the resulting negative effects of such entry and exit were marginal. In contrast, bankrupt groups turned out to rely primarily upon increasing allocative efficiency during the crisis, and the actual improvement of affiliate average productivity was marginal. They also suffered from a significant loss of affiliates which had previously been high performers before the crisis.

The initial motivation of the series of studies in this dissertation was the claim in the literature that, despite their obvious negative impacts, economic crises may have some "virtue." The essence of this claim is the concept of the hypothetical "cleansing effect" of a crisis. The theory is that a crisis purges ineffective and inefficient elements out of the economy. The "pit-stop view" also claims that a crisis turns the attention of corporations from production activity to productivity-enhancing activity. Chapter 3 investigated whether such effects would change the distribution of productivity within firms. The finding of increased dispersion of productivity posed questions about how government intervention may interact with brutal market mechanisms. Along this line, Chapter 4 analyzed the effectiveness of government-driven restructuring, the so-called "workouts." The finding of only insignificant improvements in productivity as a result of these workouts is worth noting when considering future restructuring plans. Chapter 5 turned to the examination of the market-driven restructuring efforts which occurred during the crisis. This chapter investigated the performance of portfolio restructuring by business groups in response to the rare opportunities provided by a crisis. The findings suggest that successful groups improved the average productivity of their affiliates, acquired high-performing affiliates, and discarded low-performing affiliates during the crisis. Just as the market mechanism operates in other situations, it appears that stronger groups realize the greatest benefits during a crisis.

Despite some limitations of the studies and issues of applicability, I hope the findings of this dissertation will provide useful information to academics, policy makers, and business practitioners when they confront future financial crises.

A Robust analyses for the workout Effect on the Productivity

Table 11: The Workout Effect on Productivity (2004)

Dep. Variable: Productivity (2004)	(1)	(2)	(3)	(4)	(5)	(6)
Workouts	1,205.269	1,125.535	-34.319	1,094.296	1,088.208	17.064
	(1,299.807)	(1,309.837)	(357.432)	(1,511.927)	(1,539.061)	(416.524)
Industry Effect				Yes	Yes	Yes
Producivity ('96)		-12.769	-6.955		-1.432	-21.830
		(18.112)	(7.740)		(37.714)	(12.666)
Employee ('96)			0.170			-0.091
			(0.299)			(0.405)
Asset ('96)			0.377			0.515
			(0.288)			(0.424)
Tg Asset ('96)			0.913			-0.026
			(2.918)			(3.529)
Liabilities ('96)			-1.588***			-1.457*
			(0.334)			(0.538)
Sales ('96)			0.001			0.000
			(0.001)			(0.002)
Net profit ('96)			-0.170***			-0.174***
			(0.018)			(0.026)
Op. Profit ('96)			0.192***			0.179***
			(0.012)			(0.017)
Constant	94.310	976.166	-158.067	-1,045.650	-1,103.276	-3,236.603
	(946.544)	(1,570.902)	(525.141)	(5,647.001)	(5,737.051)	(2,601.364)
Observations	66	66	66	66	66	66
R-squared	0.013	0.021	0.943	0.326	0.326	0.967

Productivty is measured by labor productivity.
Standard errors in parentheses. *** p <0.001, ** p <0.01, * p <0.05.

Table 12: The Workout Effect on Productivity (2006)

Dep. Var: Productivity (2006)	(1)	(2)	(3)	(4)	(5)	(6)
Workouts	-26.913	-21.156	-19.800	-26.407	-24.292	-17.044
	(17.092)	(15.404)	(16.149)	(18.388)	(18.424)	(17.638)
Industry Effect				Yes	Yes	Yes
Producivity ('96)		0.818***	0.728*		0.486	0.541
		(0.211)	(0.359)		(0.438)	(0.713)
Employee ('96)			-0.014			-0.000
			(0.014)			(0.022)
Asset ('96)			0.012			0.019
			(0.013)			(0.020)
Tg Asset ('96)			0.009			0.111
			(0.166)			(0.286)
Liabilities ('96)			0.007			-0.003
			(0.019)			(0.030)
Sales ('96)			-0.000			-0.000
			(0.000)			(0.000)
Net profit ('96)			0.001			0.000
			(0.001)			(0.002)
Op. Profit ('96)			-0.002			-0.001
			(0.001)			(0.002)
Constant	83.495***	25.097	25.379	69.581	27.636	69.627
	(12.286)	(18.644)	(24.210)	(64.880)	(74.864)	(71.840)
Observations	60	60	60	60	60	60
R-squared	0.041	0.242	0.364	0.488	0.506	0.703

Productivty is measured by labor productivity.
Standard errors in parentheses. *** p <0.001, ** p <0.01, * p <0.05.

B Robust analyses for the workout Effect on the Growth of Productivity

Table 13: The Workout Effect on the Growth of Productivity ('96-'04)

Dep. Variable: Growth of productivity (96-04)	(1)	(2)	(3)	(4)	(5)	(6)
Workouts	1,211.514	1,125.535	-34.319	1,098.549	1,088.208	17.064
	(1,300.634)	(1,309.837)	(357.432)	(1,511.978)	(1,539.061)	(416.524)
Industry Effect				Yes	Yes	Yes
Producivity ('96)		-13.769	-7.955		-2.432	-22.830
		(18.112)	(7.740)		(37.714)	(12.666)
Employee ('96)			0.170			-0.091
			(0.299)			(0.405)
Asset ('96)			0.377			0.515
			(0.288)			(0.424)
Tg Asset ('96)			0.913			-0.026
			(2.918)			(3.529)
Liabilities ('96)			-1.588***			-1.457*
			(0.334)			(0.538)
Sales ('96)			0.001			0.000
			(0.001)			(0.002)
Net profit ('96)			-0.170***			-0.174***
			(0.018)			(0.026)
Op. Profit ('96)			0.192***			0.179***
			(0.012)			(0.017)
Constant	25.246	976.166	-158.067	-1,086.385	-1,103.276	-3,236.603
	(947.147)	(1,570.902)	(525.141)	(5,647.193)	(5,737.051)	(2,601.364)
Observations	66	66	66	66	66	66
R-squared	0.013	0.022	0.944	0.327	0.327	0.967

Productivty is measured by labor productivity.
Standard errors in parentheses. *** p <0.001, ** p <0.01, * p <0.05.

Table 14: The Workout Effect on the Growth of Productivity ('96-'06)

Dep. Var. : Growth of productivity (96-06)	(1)	(2)	(3)	(4)	(5)	(6)
Workouts	-19.878	-21.156	-19.800	-22.060	-24.292	-17.044
	(15.298)	(15.404)	(16.149)	(18.424)	(18.424)	(17.638)
Industry Effect				Yes	Yes	Yes
Producivity ('96)		-0.182	-0.272		-0.514	-0.459
		(0.211)	(0.359)		(0.438)	(0.713)
Employee ('96)			-0.014			-0.000
			(0.014)			(0.022)
Asset ('96)			0.012			0.019
			(0.013)			(0.020)
Tg Asset ('96)			0.009			0.111
			(0.166)			(0.286)
Liabilities ('96)			0.007			-0.003
			(0.019)			(0.030)
Sales ('96)			-0.000			-0.000
			(0.000)			(0.000)
Net profit ('96)			0.001			0.000
			(0.001)			(0.002)
Op. Profit ('96)			-0.002			-0.001
			(0.001)			(0.002)
Constant	12.130	25.097	25.379	-16.641	27.636	69.627
	(10.996)	(18.644)	(24.210)	(65.010)	(74.864)	(71.840)
Observations	60	60	60	60	60	60
R-squared	0.028	0.041	0.196	0.350	0.375	0.625

Productivty is measured by labor productivity.
Standard errors in parentheses. *** p <0.001, ** p <0.01, * p <0.05.

References

Ackerberg, D., K. Caves, and G. Frazer (2006). Structural estimation of production functions. *manuscript. Department of Economics, UCLA*.

Aghion, P. and G. Saint-Paul (1991). On the virtue of bad times: an analysis of the interaction between economic fluctuations and productivity growth. Report, DELTA (Ecole normale superieure).

Aghion, P. and G. Saint-Paul (1993). Uncovering some causal relationships between productivity growth and the structure of economic fluctuation: A tentative survey. *NBER Working Paper Series No. 4603*.

Aghion, P. and G. Saint-Paul (1998). Virtues of bad times: Interaction between productivity growth and economic fluctuations. *Macroeconomic Dynamics 2*(03), 322–344.

Ahearne, A. G. and N. Shinada (2005). Zombie firms and economic stagnation in japan. *International Economics and Economic Policy 2*(4), 363–381.

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

Amsden, A. H. (2001). *The Rise of the Rest: Challenges to the West from Late-Industrializing Economies*. Oxford: Oxford University Press.

Austin, P. C. (2008). A critical appraisal of propensity-score matching in the medical literature between 1996 and 2003. *Statistics in Medicine 27*(12), 2037–2049.

Austin, P. C. (2009). Balance diagnostics for comparing the distribution of baseline

covariates between treatment groups in propensity-score matched samples. *Statistics in Medicine 28*(25), 3083–3107.

Bae, G. S., S. C. Youngsoon, and J.-K. Kang (2008). Intragroup propping: Evidence from the stock-price effects of earnings announcements by korean business groups. *The Review of Financial Studies 21*(5), 2015–2060.

Baek, C., Y. Kim, and H. Kwon (2009). Productivity growth and competition across the asian financial crisis: Evidence from korean manufacturing firms.

Baily, M. N., E. J. Bartelsman, and J. Haltiwanger (1996). Downsizing and productivity growth: Myth or reality? *Small Business Economics 8*(4), 259–278.

Baily, M. N., C. Hulten, and D. Campbell (1992). Productivity dynamics in manufacturing plants. *Brookings Papers on Economic Activity. Microeconomics 1992*, 187–267.

Balasubramanian, N. (2007). *Essays on learning and innovation*. Thesis.

Balasubramanian, N. and M. B. Lieberman (2010). Industry learning environments and the heterogeneity of firm performance. *Strategic Management Journal 31*(4), 390–412.

Barlevy, G. (2002). The sullying effect of recessions. *The Review of Economic Studies 69*(1), 65–96.

Barlevy, G. (2003). Credit market frictions and the allocation of resources over the business cycle. *Journal of Monetary Economics 50*(8), 1795–1818.

Barney, J. B. (1986). Strategic factor markets: Expectations, luck, and business strategy. *Management Science 32*(10), 1231–1241.

Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management 17*(1), 99–120.

Bartelsman, E. J. and M. Doms (2000). Understanding productivity: Lessons from longitudinal microdata. *Journal of Economic Literature 38*(3), 569–594.

Basu, A., J. J. Heckman, S. Navarro-Lozano, and S. Urzua (2007). Use of instrumental variables in the presence of heterogeneity and self-selection: an application to treatments of breast cancer patients. *Health Economics 16*(11), 1133–1157.

Basu, A., D. Polsky, and W. Manning (2008). Use of propensity scores in non?linear response models: the case for health care expenditures. *NBER Working Paper No. 14086*, Available at: http://www.nber.org/papers/w1408602138.

Beck, P. M. (1998). Revitalizing korea's chaebol. *Asian Survey 38*(11), 1018–1035.

Benjamin, D. and F. Meza (2009). Total factor productivity and labor reallocation: the case of the korean 1997 crisis. *The BE Journal of Macroeconomics 9*(1).

Bergh, D. D. and M. W. Lawless (1998). Portfolio restructuring and limits to hierarchical governance: The effects of environmental uncertainty and diversification strategy. *Organization Science 9*(1), 87–102.

Bernanke, B. S. (1983). Nonmonetary effects of the financial crisis in the propagation of the great depression. *The American Economic Review 73*(3), 257–276.

Bordo, M., B. Eichengreen, D. Klingebiel, and M. S. Martinez-Peria (2001). Is the crisis problem growing more severe? *Economic Policy 16*(32), 51–82.

Bowman, E. H. and H. Singh (1993). Corporate restructuring: Reconfiguring the firm. *Strategic Management Journal 14*(ArticleType: research-article / Issue Title:

Special Issue: Corporate Restructuring / Full publication date: Summer, 1993 / Copyright 1993 Wiley), 5–14.

Brandt, E., S. Dressler, and E. Quintin (2004). The real impact of financial crises. *Economic and Financial Policy Review 3*(1), 1–15.

Bresnahan, T. F. and D. M. Raff (1991). *Intra-industry heterogeneity and the Great Depression: The American motor vehicle industry 1929-1935*. Cambridge Univ Press.

Bresnahan, T. F. and D. M. G. Raff (1993). Technological heterogeneity, adjustment costs, and the dynamics of plant-shut-down behavior: The american motor vehicle industry in the time of the great depression.

Brown, J. D. and J. S. Earle (2008). Understanding the contributions of reallocation to productivity growth: Lessons from a comparative firm-level analysis. *IZA Working Paper* (3638).

Caballero, R. J. and M. L. Hammour (1994). The cleansing effect of recessions. *The American Economic Review 84*(5), 1350–1368.

Caballero, R. J., T. Hoshi, and A. K. Kashyap (2008). Zombie lending and depressed restructuring in japan. *The American Economic Review 98*(5), 1943–1977.

Caprio, G. and D. Klingebiel (2003). Episodes of systemic and borderline financial crises. In D. Klingebiel and L. Laeven (Eds.), *Managing the Real and Fiscal Effects of Banking Crises*. World Bank Publications.

Chang, H.-J. and H.-J. Park (2004). An alternative perspective on government policy towards the chaebol in korea: Industrial policy, financial regulations, and political

democracy. In S.-H. Jwa and I. K. Lee (Eds.), *Competition and Corporate Governance in Korea: Reforming and Restructuring the Chaebol*, pp. 24–61. Northampton, MA: Edward Elgar.

Chang, S.-J. (2003). *Financial crisis and transformation of Korean business groups: The rise and fall of chaebols*. Cambridge, UK: Cambridge university press.

Chang, S.-J. (2006a). Business groups in east asia: Post-crisis restructuring and new growth. *Asia Pacific Journal of Management 23*(4), 407–417.

Chang, S.-J. (2006b). Korean business groups: The financial crisis and the restructuring of chaebols. In S.-J. Chang (Ed.), *Business groups in East Asia*, pp. 52–69. New York: Oxford University Press.

Chang, S. J. and J. Hong (2000). Economic performance of group-affiliated companies in korea: Intragroup resource sharing and internal business transactions. *The Academy of Management Journal 43*(3), 429–448.

Chang, S. J. and J. Hong (2002). How much does the business group matter in korea? *Strategic Management Journal 23*(3), 265–274.

Chatterjee, S. (1992). Sources of value in takeovers: Synergy or restructuring-implications for target and bidder firms. *Strategic Management Journal 13*(4), 267–286.

Cherry, J. (2005). big deal or big disappointment? the continuing evolution of the south korean developmental state. *The Pacific Review 18*(3), 327–354.

Choe, S. and T. W. Roehl (2007). What to shed and what to keep: Corporate transformation in korean business groups. *Long Range Planning 40*(4?5), 465–487.

Choi, J.-P. (2009). Chaebol reforms and new chaebols. *The Korean Journal of Industrial Organization 17*(1), 45–66 (in Korean).

Choi, J.-P. (2010). A comparison of management structure between the rising and falling chaebols. *The Korean Journal of Industrial Organization 18*(3), 79–101 (in Korean).

Choi, J.-P. and T. Cowing (2002). Diversification, concentration and economic performance: Korean business groups. *Review of Industrial Organization 21*(3), 271–282.

Choo, K., K. Lee, K. Ryu, and J. Yoon (2009). Changing performance of business groups over two decades: Technological capabilities and investment inefficiency in korean chaebols. *Economic Development and Cultural Change 57*(2), 359–386.

Claessens, S. (2005). Policy approaches to corporate restructuring around the world: What worked, what failed? In M. Pomerleano and W. Shaw (Eds.), *Corporate Restructuring: Lessons from Experience*, pp. 11–58. Washington, D.C.: World Bank Publications.

Coase, R. H. (1937). The nature of the firm. *Economica 4*(16), 386–405.

Dado, M. E. and D. Klingebiel (2002). *Decentralized creditor-led corporate restructuring: cross-country experience*, Volume 2901. World Bank Publications.

Darwin, C. (1859). *On the origin of species by means of natural selection*. London: John Murray.

Davis, L. (1991). *Handbook of Genetic Algorithms*. New York: Van Nostrand Reinhold.

Davis, S. J. and J. Haltiwanger (1992). Gross job creation, gross job destruction, and employment reallocation. *The Quarterly Journal of Economics 107*(3), 819–863.

de Figueiredo, J. M. and M. K. Kyle (2006). Surviving the gales of creative destruction: the determinants of product turnover. *Strategic Management Journal 27*(3), 241–264.

Deal, T. (1985). Cultural change: Opportunity, silent killer, or metamorphosis? In R. Kilmann, M. Saxton, and R. Serpa (Eds.), *Gaining control of the corporate culture*, pp. 292–331. San Francisco: Jossey-Bass.

Devine, H., T. Doan, K. Iyer, P. Mok, and P. Stevens (2012). Decomposition of new zealand firm productivity, 2001-2008.

Dharwadkar, B., G. George, and P. Brandes (2000). Privatization in emerging economies: An agency theory perspective. *Academy of Management Review 25*(3), 650–669.

Diamond, A. and J. S. Sekhon (2012). Genetic matching for estimating causal effects: A general multivariate matching method for achieving balance in observational studies. *Review of Economics and Statistics*.

Drake, C. (1993). Effects of misspecification of the propensity score on estimators of treatment effect. *Biometrics 49*(4), 1231–1236.

Duhaime, I. M. and J. H. Grant (1984). Factors influencing divestment decision-making: Evidence from a field study. *Strategic Management Journal 5*(4), 301–318.

Dwyer, D. W. (1998). Technology locks, creative destruction, and nonconvergence in productivity levels. *Review of Economic Dynamics 1*(2), 430–473.

Evans, P. (1995). *Embedded Autonomy: States and Industrial Transformation*. Princeton, NJ: Princeton University Press.

Fields, K. J. (1995). *Enterprise and the State in Korea and Taiwan.* Ithaca, New York: Cornell University Press.

Foster, L., J. Haltiwanger, and C. Syverson (2008). Reallocation, firm turnover, and efficiency: Selection on productivity or profitability? *The American Economic Review 98*(1), 394–425.

Foster, L., J. C. Haltiwanger, and C. J. Krizan (2001). Aggregate productivity growth. lessons from microeconomic evidence. In C. R. Hulten, E. R. Dean, and M. J. Harpe (Eds.), *New Developments in Productivity Analysis*, pp. 303–372. Chicago and London: University of Chicago Press.

Fukao, K. and H. U. Kwon (2006). Why did japan's tfp growth slow down in the lost decade? an empirical analysis based on firm-level data of manufacturing firms*. *Japanese Economic Review 57*(2), 195–228.

Gerschenkron, A. (1962). *Economic Backwardness in Historical Perspective: A Book of Essay.* Cambridge, MA: The Belknap Press of Harvard University Press.

Gersick, C. J. G. (1991). Revolutionary change theories: A multilevel exploration of the punctuated equilibrium paradigm. *The Academy of Management Review 16*(1), 10–36.

Ghemawat, P. and B. Nalebuff (1985). Exit. *The RAND Journal of Economics 16*(2), 184–194.

Gilligan, M. J. and E. J. Sergenti (2008). Do un interventions cause peace? using matching to improve causal inference. *Quarterly Journal of Political Science 3*(2), 89–122.

Gilson, S. C., K. John, and L. H. P. Lang (1990). Troubled debt restructurings: An empirical study of private reorganization of firms in default. *Journal of Financial Economics 27*(2), 315–353.

Ginsberg, A. and A. Bucholtz (1990). Converting to for-profit status: Corporate responsiveness to radical change. *Academy of Management Journal 33*(3), 445–477.

Glodberg, D. E. (1989). *Genetic algorithms in search, optimization, and machine learning*. Reading, MA: Addion Wesley.

Gokhale, J. (2009). Financial crisis and public policy.

Goldstein, H. (1987). *Multilevel models in education and social research*. Oxford University Press.

Granovetter, M. (1994). Business groups. In N. J. Smelser and R. Swedberg (Eds.), *Handbook of Economic Sociology*. Princeton, NJ: Princeton University Press.

Granovetter, M. (1995). Coase revisited: Business groups in the modern economy. *Industrial and Corporate Change 4*(1), 93–130.

Griffith, R., J. Haskel, and A. Neely (2006). Why is productivity so dispersed? *Oxford Review of Economic Policy 22*(4), 513–525.

Griliches, Z. and H. Regev (1995). Firm productivity in israeli industry: 1979-1998. *Journal of Econometrics 65*, 175–203.

Guthrie, D. (1997). Between markets and politics: Organizational responses to reform in china. *American Journal of Sociology 102*(5), 1258–1304.

Haley, U. C. V. (2000). Corporate governance and restructuring in east asia : An overview. *Seoul Journal of Economics 13*(3), 225–252.

Hallward-Driemeier, M. and B. Rijkers (2011). Do crises catalyze creative destruction? firm-level evidence from indonesia. *World Bank Policy Research Working Paper Series (5869)*.

Hamilton, G. G. and N. W. Biggart (1988). Market, culture, and authority: A comparative analysis of management and organization in the far east. *American Journal of Sociology 94*, S52–S94.

Hanani, A. (2006). Indonesian business groups: the crisis in progress. In S.-J. Chang (Ed.), *Business Groups in East Asia*, pp. 179–204. New York: Oxford Universiry Press.

Hannan, M. T. and J. Freeman (1977). The population ecology of organizations. *American Journal of Sociology 82*(5), 929–964.

Helpman, E. (2006). Trade, fdi, and the organization of firms. *Journal of Economic Literature 44*(3), 589–630.

Hinds, M. (1988). Economic effects of financial crises. Report, The World Bank.

Hirshman, A. (1958). *The Strategy of Economic Development*. New Haven, CT: Yale University Press.

Hitt, M. A., J. S. Harrison, and R. D. Ireland (2001). *Mergers and Acquisitions: A Guide to Creating Value for Stakeholders*. New York: Oxford University Press.

Ho, D. E., K. Imai, G. King, and E. A. Stuart (2007). Matching as nonparametric preprocessing for reducing model dependence in parametric causal inference. *Political Analysis 15*(3), 199–236.

Holland, J. H. (1975). *Adaptation in natural and artificial systems.* Ann Arbor: University of Michigan Press.

Holland, P. W. (1986). Statistics and causal inference. *Journal of the American Statistical Association 81*(396), 945–960.

Horner, A., J. Beauchamp, and L. Haken (1993). Machine tongues xvi: Genetic algorithms and their application to fm matching synthesis. *Computer Music Journal 17*(4), 17–29.

Hoskisson, R. E. and M. A. Hitt (1994). *Downscoping: How to Tame the Diversified Firm.* New York: Oxford University Press.

Hoskisson, R. E., R. A. Johnson, D. Yiu, and W. P. Wan (2001). Restructuring strategies of diversified business groups: differences associated with country institutional environments. In M. A. Hitt, E. R. Freeman, and J. S. Harrison (Eds.), *The Blackwell Handbook of Strategic Management.* Oxford, UK: Blackwell Publishers.

Hoskisson, R. E., A. A. C. Jr, L. Tihanyi, and R. Faraci (2004). Asset restructuring and business group affiliation in french civil law countries. *Strategic Management Journal 25*(6), 525–539.

Imbens, G. W. (2004). Nonparametric estimation of average treatment effects under exogeneity: A review. *Review of Economics and Statistics 86*(1), 4–29.

Imbens, G. W. and J. M. Wooldridge (2009). Recent developments in the econometrics of program evaluation. *Journal of Economic Literature 47*(1), 5–86.

Ismail, M. N. (2009). Financial crises: Can they be prevented?

Ito, K. and S. Lechevalier (2009). The evolution of the productivity dispersion of firms: a reevaluation of its determinants in the case of japan. *Review of World Economics 145*(3), 405–429.

Jickling, M. (2008). Averting financial crisis. Report, Congressional Research Service, Library of Congress.

Johnson, C. (1984). *The Industrial Policy Debate*. San Francisco: ICS Press.

Johnson, R. A. (1996). Antecedents and outcomes of corporate refocusing. *Journal of Management 22*, 439–483.

Jones, A. M. (2007). Identification of treatment effects in health economics. *Health Economics 16*(11), 1127–1131.

Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrica 50*(3), 649–670.

Kalinowski, T. (2008). Korea's recovery since the 1997/98 financial crisis: The last stage of the developmental state. *New Political Economy 13*(4), 447–462.

Kang, D. S. (2004). Success factors of the korean corporate workouts. *KDI Journal of Economic Policy 26*(1), 71–104 (in Korean).

Kang, D. S. and S. G. Han (2001). The analysis on the performance of workout program. *Journal of Korean Economic Analysis 7*, 123–168 (in Korean).

Katz, D. and R. Kahn (1966). *The Social Psychology of Organizations*. New York: Wiley.

Keister, L. A. (1998). Engineering growth: Business group structure and firm performance in china's transition economy. *American Journal of Sociology 104*(2), 404–440.

Keister, L. A. (1999). Where do strong ties come from? a dyad analysis of the strength of interfirm exchange relations during china's economic transition. *International Journal of Organizational Analysis 7*(1), 5–24.

Keister, L. A. (2001). Exchange structures in transition: Lending and trade relations in chinese business groups. *American Sociological Review 66*(3), 336–360.

Kent, P. (1997). Corporate workouts ? a uk perspective. *International Insolvency Review 6*(3), 165–182.

Khandker, S. R., G. B. Koolwal, and H. A. Samad (2010). *Handbook on impact evaluation: quantitative methods and practices*. World Bank Publications.

Khanna, T. and K. Palepu (1997). Why focused strategies may be wrong for emerging markets. *Harvard Business Review* (July-August), 41.

Khanna, T. and K. Palepu (1999a). Policy shocks, market intermediaries, and corporate strategy: The evolution of business groups in chile and india. *Journal of Economics & Management Strategy 8*(2), 271–310.

Khanna, T. and K. Palepu (1999b). The right way to restructure conglomerates in merging markets. *Harvard Business Review 77*(4, July/August), 125.

Khanna, T. and K. Palepu (2000). Is group affiliation profitable in emerging markets? an analysis of diversified indian business groups. *The Journal of Finance 55*(2), 867–891.

Khanna, T. and J. W. Rivkin (2001). Estimating the performance effects of business groups in emerging markets. *Strategic Management Journal 22*(1), 45–74.

Khanna, T. and Y. Yafeh (2007). Business groups in emerging markets: Paragons or parasites? *Journal of Economic Literature 45*(2), 331–372.

Kim, D. I. (2002). The korean labor market: The crisis and after. In T. C. David and S. Kim (Eds.), *Korean Crisis and Recovery*. Washington: International Monetary Fund: Korea Institute for International Economic Policy.

Kim, E.-M. (1997). *Big Business, Strong State: Collusion and Conflict in South Korean Developments, 1960-1990*. New York: State University of New York Press.

Kim, H. Y. (2004). The study on the effect of governmental support for small firms. *Korea Development Institute (in Korean)*.

Kimberly, J. and R. Quinn (1984). *New futures: The challenge of managing corporate transitions*. Homewood, IL: Dow Jones-Irwin.

Kindleberger, C. P. and R. Z. Aliber (2005). *Manias, Panics and Crashes: A History of Financial Crises*. New York: Palgrave MacMillan.

Koo, J. and S. L. Kiser (2001). Recovery from a financial crisis: the case of south korea. *Economic and Financial Policy Review* (Q IV), 24–36.

Krueger, A. O. and J. Yoo (2002). Chaebol capitalism and the currency-financial crisis in korea. In Edwards and Frankel (Eds.), *Preventing currency crises in emerging markets*, pp. 601–662. University of Chicago Press.

Lee, C. H. (2003a). To thine ownself be true: Imf conditionality and erosion of economic sovereignty in the asian financial crisis. *University of Pennsylvania Journal of International Economic Law 24*(4), 875–904.

Lee, C. S. (1998). Give me your sick. *Far Eastern Economic Review 2*(July).

Lee, D. G. (2003b). The restructuring of daewoo. In S. Haggard, W. Lim, and E. Kim (Eds.), *Economic Crisis and Corporate Restructuring in Korea: Reforming the Chaebol*, pp. 150–180. Cambridge: Cambridge University Press.

Lee, I. K. (2004a). Government-led restructuring of firms' excess capacity and its limits: Korean 'big deal' case. In S.-H. Jwa and I. K. Lee (Eds.), *Competition and Corporate Governance in Korea: Reforming and Restructuring the Chaebol*, pp. 195–215. Northampton, MA: Edward Elgar.

Lee, J.-W. (2004b). Chaebol restructuring revisited: A coasian perspective. In S.-H. Jwa and I. K. Lee (Eds.), *Competition and Corporate Governance in Korea: Reforming and Restructuring the Chaebol*. Northampton, MA: Edward Elgar Publishing, Inc.

Lee, K., M. W. Peng, and K. Lee (2008). From diversification premium to diversification discount during institutional transitions. *Journal of World Business 43*(1), 47–65.

Lee, K.-S. (2011). *The Korean financial crisis of 1997: onset, turnaround, and thereafter*. World Bank Publications.

Leff, N. H. (1978). Industrial organization and entrepreneurship in the developing countries: The economic groups. *Economic Development and Cultural Change 26*(4), 661–675.

Lieberman, M. B. (1989). The learning curve, technology barriers to entry, and competitive survival in the chemical processing industries. *Strategic Management Journal 10*(5), 431–447.

Lieberman, M. B. and J. Kang (2008). How to measure company productivity using value-added: A focus on pohang steel (posco). *Asia Pacific J Manage 25*, 209–224.

Lippman, S. A. and R. P. Rumelt (1982). Uncertain imitability: An analysis of interfirm differences in efficiency under competition. *The Bell Journal of Economics 13*(2), 418–438.

Mako, W. P. (2002). Corporate restructuring and reform: Lessons from korea. In D. T. Coe and S.-J. Kim (Eds.), *Korean Crisis and Recovery*, pp. 203–228. Washington, D.C.: International Monetary Fund.

Mako, W. P. (2005). Emerging-market and crisis applications for out-of-court workouts: Lessons from east asia, 1998 - 2001. In M. Pomerleano and W. Shaw (Eds.), *Corporate Restructuring: Lessons from Experience*, pp. 99–126. Washington, D.C.: World Bank Publications.

Maliranta, M. (2001). Productivity growth and micro-level restructuring. finnish experiences during the turbulent decades. Report, The Research Institute of the Finnish Economy.

March, J. and H. Simon (1958). *Organizations*. New York: Wiley.

Markides, C. C. (1992). Consequences of corporate refocusing: Ex ante evidence. *The Academy of Management Journal 35*(2), 398–412.

Mayer, A. K. (2011). Does education increase political participation? *The Journal of Politics 73*(03), 633–645.

McGahan, A. M. and M. E. Porter (1997). How much does industry matter, really? *Strategic Management Journal 18*, 15–30.

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica 71*(6), 1695–1725.

Melitz, M. J. and S. Polanec (2012). Dynamic olley-pakes productivity decomposition with entry and exit. *National Bureau of Economic Research Working Paper Series No. 18182*.

Meyer, A. D., G. R. Brooks, and J. B. Goes (1990). Environmental jolts and industry revolutions: Organizational responses to discontinuous change. *Strategic Management Journal 11*, 93–110.

Meyerman, G. E. (2000). The london approach and corporate debt restructuring in east asia. In C. Adams, R. E. Litan, and M. Pomerleano (Eds.), *Managing Financial and Corporate Distress: Lessons from Asia*, pp. 299–321. Washington, D.C.: Brookings Institution.

Meza, F. and E. Quintin (2006). Financial crises and total factor productivity. *Federal Reserve Bank of Dallas Working Paper*.

Nelson, R. R. (1981). Research on productivity growth and productivity differences: Dead ends and new departures. *Journal of Economic Literature 19*(3), 1029–1064.

Nelson, R. R. and S. Winter (1982). *An Evolutionary Theory of Economic Change*. Cambridge, MA: Belknap Press.

Nishimura, K. G., T. Nakajima, and K. Kiyota (2005). Does the natural selection mechanism still work in severe recessions?: Examination of the japanese economy in the 1990s. *Journal of Economic Behavior & Organization 58*(1), 53–78.

Nolan, P. (2001). *China and the Global Economy: National Champions, Industry Policy, and the Big Business Revolution*. Basingstoke, New York: Palgrave.

North, D. C. (1990). *Institutions, institutional change, and economic performance*. New York, NY: Cambridge University Press.

Oh, S.-G. (2006). A study on workout (corporate restructuring). *Commercial Law Review 24*(4), 117–156 (in Korean).

Ohanian, L. E. (2001). Why did productivity fall so much during the great depression? *The American Economic Review 91*(2), 34–38.

Olivie, I. (2009). What makes this financial crisis different from others? *Working paper, Elcano Royal Institute*.

Olley, G. S. and A. Pakes (1996). The dynamics of productivity in the telecommunications equipment industry. *Econometrica 64*(6), 1263–1297.

Orru, M., N. W. Biggart, and G. G. Hamilton (1997). *The Economic Organization of East Asian Capitalism*. Thousand Oaks, CA: Sage.

Oulton, N. (1998). Competition and the dispersion of labour productivity amongst uk companies. *Oxford Economic Papers 50*(1), 23–38.

Ouyang, M. (2009). The scarring effect of recessions. *Journal of Monetary Economics 56*(2), 184–199.

Park, C.-u. (2005). Rescuing business: Reorganizing bankrupt firms as organizational processes. *Development and society 34*(1), 49–73.

Park, K. S. (2003). The restructuring of daewoo. In S. Haggard, W. Lim, and E. Kim (Eds.), *Economic Crisis and Corporate Restructuring in Korea: Reforming the Chaebol*, pp. 181–206. Cambridge: Cambridge University Press.

Park, S. I., C. J. Kim, and H. D. Shin (2011). Workout effects on profitability and cash flows. *Korean Corporation Management Review 18*(4), 63–80 (in Korean).

Penrose, E. T. (1959). *The Theory of Growth of the Firm*. Oxford: Oxford University Press.

Polsiri, P. and Y. Wiwattanakantang (2006). Thai business groups: crisis and restructuring. In S.-J. Chang (Ed.), *Business Groups in East Asia: Financial Crisis, Restructuring, and New Growth*, pp. 147–79. New York.

Rajagopalan, N. and G. Spreitzer (1997). Toward a theory of strategic change: a multi-lens perspective and integrative framework. *Academy of Management Review 22*, 48–79.

Rajan, R. S. and I. Sugema (2000). Government bailouts and monetary disequilibrium: common fundamentals in the mexican and east asian currency crises. *The North American Journal of Economics and Finance 11*(2), 123–135.

Ramsahai, R., R. Grieve, and J. Sekhon (2011). Extending iterative matching methods: an approach to improving covariate balance that allows prioritisation. *Health Services and Outcomes Research Methodology 11*(3-4), 95–114.

Reinhart, C. M. and K. Rogoff (2009). *This time is different: Eight centuries of financial folly*. Princeton University Press.

Rodrik, D. (1996). Understanding economic policy reform. *Journal of Economic Literature 34*(1), 9–41.

Rosenbaum, P. and D. Rubin (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika 70*(1), 41–55.

Rosenbaum, P. R. (2010). *Design of Observational Studies*. New York: Spinger.

Rosenbaum, P. R. and D. B. Rubin (1984). Reducing bias in observational studies using subclassification on the propensity score. *Journal of the American Statistical Association 79*(387), 516–524.

Rosenbaum, P. R. and D. B. Rubin (1985). Constructing a control group using multivariate matched sampling methods that incorporate the propensity score. *The American Statistician 39*(1), 33–38.

Roubini, N. and S. Mihm (2010). *Crisis economics: A crash course in the future of finance*. Penguin Press HC.

Rumelt, R. P. (1991). How much does industry matter? *Strategic Management Journal 12*(3), 167–185.

Sakakibara, M. (1997). Heterogeneity of firm capabilities and cooperative research and development: An empirical examination of motives. *Strategic Management Journal 18*, 143–164.

Schmalensee, R. (1985). Do markets differ much? *The American Economic Review 75*(3), 341–351.

Schneider, B. R. (1997). Big business and the politics of economic reform: confidence and concertation in brazil and mexico. In S. Maxfield and B. R. Schneider (Eds.), *Business and the state in developing countries*, pp. 191–215. Ithaca, New York: Cornell University Press.

Schneider, B. R. (2009). Business groups and the state: The politics of expansion, restructuring, and collapse. *APSA 2009 Toronto Meeting Paper. Available at SSRN: http://ssrn.com/abstract=1449087*.

Schneider, B. R. (2010). Business groups and the state: The politics of expansion, restructuring, and collapse. In A. M. Colpan, T. Hikino, and J. R. Lincoln (Eds.), *The Oxford Handbook of Business Groups*. New York: Oxford University Press.

Schuh, S. and R. K. Triest (1998). Job reallocation and the business cycle: New facts for an old debate. In J. Fuhrer and S. Schuh (Eds.), *Beyond Shock: What Causes Business Cycles?*, Volume No. 42, pp. 271–337. Federal Reserve Bank of Boston.

Schumpeter, J. A. (1939). *Business Cycles: A Theoretical, Historical, and Statistical Analysis*. New York: McGraw-Hill Company.

Schumpeter, J. A. (1942). *Capitalism, Socialism, and Democracy*. New York: Harper.

Sekhon, J. S. (2011). Multivariate and propensity score matching software with automated balance optimization: The matching package for r. *Journal of statistical software 42*(7), 1–52.

Sekhon, J. S. (2013). Package matching. *R manual*.

Sekhon, J. S. and R. D. Grieve (2012). A matching method for improving covariate balance in cost-effectiveness analyses. *Health Economics 21*(6), 695–714.

Sekhon, J. S. and W. R. Mebane (1998). Genetic optimization using derivatives. *Political Analysis 7*(1), 187–210.

Singh, H. (1993). Challenges in researching corporate restructuring. *Journal of Management Studies 30*(1), 147–172.

Stone, M. R. (2000). *Large-scale post-crisis corporate sector restructuring*, Volume 7. International Monetary Fund Washington, DC.

Strachan, H. W. (1976). *Family and Other Business Groups in Economic Development*. New York: Praeger.

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical science : a review journal of the Institute of Mathematical Statistics 25*(1), 1–21.

Syverson, C. (2004a). Market structure and productivity: A concrete example. *Journal of Political Economy 112*(6), 1181–1222.

Syverson, C. (2004b). Product substitutability and productivity dispersion. *The Review of Economics and Statistics 86*(2), 534–550.

Teece, D. J., G. Pisano, and A. Shuen (1997). Dynamic capabilities and strategic management. *Strategic Management Journal 18*(7), 509–533.

Tsui, K. T. and Y. C. Cheng (1999). School organizational health and teacher commitment: A contingency study with multi-level analysis. *Educational Research and Evaluation 5*(3), 249–268.

Tushman, M. and E. Romanelli (1985). Organizational evolution: A metamorphosis model of convergence and reorientation. In B. S. Cummins (Ed.), *Research in Organizational Behavior*. Greenwich, CT: JAI Press.

van Ewijk, C. (1997). Entry and exit, cycles, and productivity growth. *Oxford Economic Papers 49*(2), 167–187.

Wang, L., H. J. Siegel, V. P. Roychowdhury, and A. A. Maciejewski (1997). Task matching and scheduling in heterogeneous computing environments using a genetic-algorithm-based approach. *Journal of Parallel and Distributed Computing 47*(1), 8–22.

Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal 5*(2), 171–180.

Whitley, R. D. (1991). The social construction of business systems in east asia. *Organization Studies 12*(1), 1–28.

Wilcox, R. (2005). Kolmogorov?smirnov test. In *Encyclopedia of Biostatistics*. John Wiley & Sons, Ltd.

Williamson, O. E. (1975). *Markets and hierarchies*. New York: Free Press.

Williamson, O. E. (1981). The modern corporation: Origins, evolution, attributes. *Journal of Economic Literature 19*(4), 1537–1568.

Williamson, O. E. (1985). *The economic intstitutions of capitalism*. New York: Free Press.

Winter, S. and R. Nelson (1982). An evolutionary theory of economic change. *University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship*.

Yiu, D., G. D. Bruton, and Y. Lu (2005). Understanding business group performance in an emerging economy: Acquiring resources and capabilities in order to prosper*. *Journal of Management Studies 42*(1), 183–206.

Yiu, D. W., Y. Lu, G. D. Bruton, and R. E. Hoskisson (2007). Business groups: An integrated model to focus future research. *Journal of Management Studies 44*(8), 1551–1579.

Yoon, J. C. (2007). *From Crisis to Advancement: the 10-Year Story of Restructuring Korea's Financial Sector*, Volume Volume 1 and 2. Beebooks (In Korean).

Zajac, E. J. and M. S. Kraatz (1993). A diametric forces model of strategic change: Assessing the antecedents and consequences of restructuring in the higher education industry. *Strategic Management Journal 14*(S1), 83–102.