PhD Thesis

An Economic Approach to the Roles of Social Capital in post-Disaster Recovery and Reconstruction: Empirical studies from Japan and its implication to the Great East Japan Earthquake

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Executive Summary

The fourth largest earthquake in recorded history struck Japan on March 11, 2011. The resulting tsunami was devastating – tsunamis of this scale occur only once every few hundred years – and claimed approximately 20,000 lives. Recent studies have confirmed that in the last two decades there has been an upward trend in the number of disasters. In view of the increasing frequency, it is an urgent task for us to build resilient societies to external shocks. How can such societies be built?

Figure 1 shows the ward by ward population data for Kobe before and after the earthquake in 1995. As the figure shows some wards recovered more quickly than others. There was a sharp population decline after the earthquake, which killed 6,343 people, and in total around 85,000 people left Kobe that year. It took almost ten years for the population to return to its 1994 level. As the figure shows, there are four population patterns among the nine wards: 1) population declined after the earthquake, but bounced back well (Higashi-nada, Nada, Chuo); 2) population declined after the earthquake, and continued to decline (Nagata); 3) population decline was small (in other words, damage was minor) at the time of the earthquake, but population continued to decline (Suma, Tarumi); and 4) there was almost no impact (Kita, Nishi).

What, then, are the factors that make a difference in the rate of recovery among communities after natural disasters? Possible factors suggested in previous literature have been the magnitude of damage to infrastructure, the amount of money flowing in, the quality of governance and socio-economic conditions. However, none of these explains the differences in Kobe mentioned above, as we will discuss in Chapter1. The hypothesis of this thesis is that it is social capital that makes the difference. How, then, does social capital work?
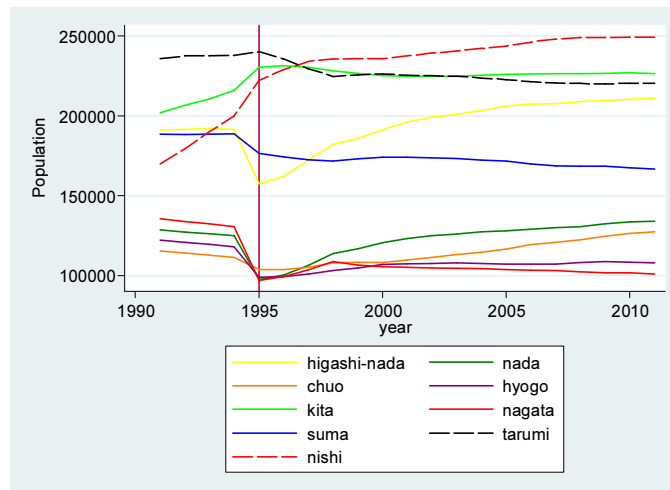

Figure 1: Population before and after the Great Hanshin Awaji Earthquake

(Source: the author)

This thesis proposes a fresh economic approach to social capital, using the concept of capital given by Irving Fisher (1906). He introduced the concepts of "stock" and "flow" to the

discussion on capital, stating that stock is capital (wealth) and flow is income (service of wealth). Social capital can be defined, then, as the stock of trustworthiness, norms, and networks. This thesis classifies individual social capital as part of human capital. In other words, this thesis will focus only on community/network social capital. One important point is that social capital works together with human capital and other types of capital, such as physical capital, financial capital, and natural capital (fig. 2).
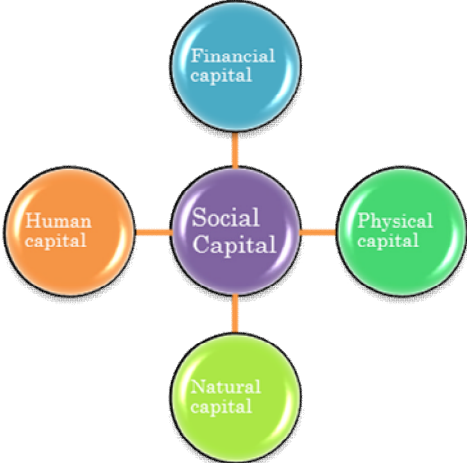

Figure 2: Social capital enhances the benefit of other types of capitals
(Source: the author)

Looking back through the history of economic thought, at the beginning of economic development privately owned finance was considered as primitive accumulation of capital (Morotomi 2010; 2003). As economies developed over the twentieth century with industrialization, private capital began to require huge public investment in infrastructure such as railways, roads, and telecommunications, which is difficult to finance privately. Physical capital itself does not create the flow of services. The services are created through use. To be used, physical capital should align with the demand of the area or it should create demand. If physical capital is connected with the social capital of an area, it will enhance the benefits of the physical capital to the area and increase the well-being of society. In other words, physical capital will benefit not only a section of the society, but the whole society. This will happen only if physical capital is linked with social capital, because it will increase the social return of the investment. The same is true of other types of capital. The stock of natural capital will be preserved and used in a sustainable way if it is connected with social capital, avoiding the tragedy of the commons. To increase the social rate of return, not just the economic rate of return, social capital is key. As the following figure shows, social capital will strengthen the social return through linking with other types of capital.

With regard to networks, this thesis considers networks as capital only if there are positive impacts on society (in other words, it excludes networks with negative externalities and individual social capital. The same applies to negative environmental externalities, which are caused in the process of production.) As a concept, if social capital causes negative externalities, it is cannot be considered as capital.

At the beginning of economic development, social capital is the key to its increase. In other words, social capital provides the conditions for development. As economies

industrialize, this role is gradually replaced by formal institution and markets. Stiglitz (2000) described this as "an inverted U-shape relationship." After a certain level of development, however, it has been observed that social capital regains its importance in giving value to products. Developed economies are now turning more and more toward a knowledge-based economy (or immaterial economy), unlike traditional industrial countries. For instance, technology companies such as Apple do not have factories in the US. Their main income comes from content rather than hardware. It would more appropriate to say that they produce hardware like the iPhone in order to sell content. The same is true of Amazon's Kindle device. In these knowledge-based economies, especially in the tertiary sector, the role of social capital becomes more important than in traditional modern industrial economies. Saxenian (1994) compared the success of Silicon Valley on the west coast of the US and the decline of Route 128 on the east coast. Based on the case studies, she concluded that the difference came from the social capital of the two regions. Silicon Valley had a richer social capital that enabled companies to flourish, surpassing the advanced region of Route 128. This is the case not only for the high-tech field: in the field of tourism, many areas now try to attract tourists not just through monuments, ruins, and heritage, but through regional features and community life. That is to say, expanding on Stiglitz's inverted U-shape curve, the role of social capital again becomes crucial after a certain level of development. Hence this thesis considers that the relationship between social capital and economic development has a cubic equation curve, as shown in the following figure.

Figure 3: Cubic equation curve of social capital
(Source: the author)
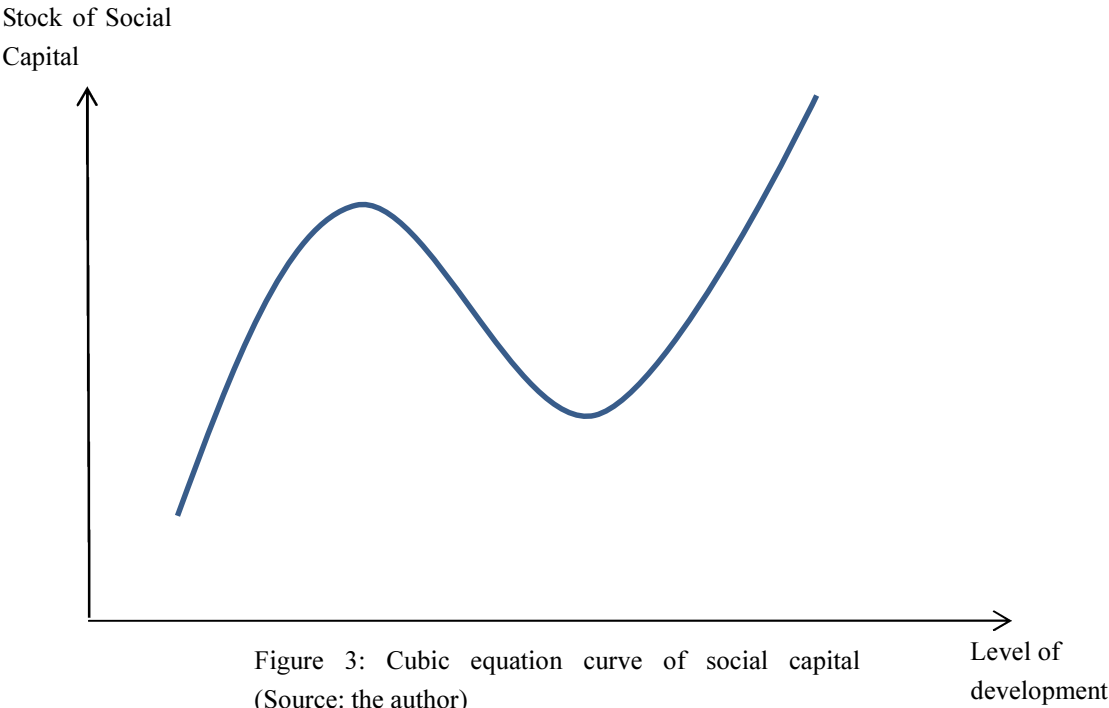
This thesis argues that social capital is one of the three main components that make societies function. The others are formal institutions and markets, and these complement each other (fig. 4). However, when external shocks hit societies, neither markets nor formal institutions can extend all the necessary help. Figure 5 shows how these three factors work before and after external shocks throughout the recovery and reconstruction phase. The vertical axis shows the component proportion ratio of social function. The upper end is the total social function a society needs from formal institutions, markets and social capital. The horizontal axis shows time. From left to right it moves from the normal situation, through

disaster, recovery, then reconstruction. The left side shows that, in normal conditions, the role of social capital compared with institutions and markets is relatively small. However, when disasters occur, relative to the emergency needs of society the role of formal institutions and markets is small. People rely on social capital in emergency situations. Neighbors are the first to extend help to victims, including physical help (tools, living space, and food), information sharing, financial aid, etc. Second, social capital works with institutions, helping victims to find out where help is provided, and catalyzing information so that government and NGOs (non-governmental organizations) can reach vulnerable people (e.g. the elderly and disabled). This reduces lonely deaths and mitigates the migration of people. Third, social capital enables people to act collectively and coordinates discussion between government and residents, which is critical to the process of recovery.
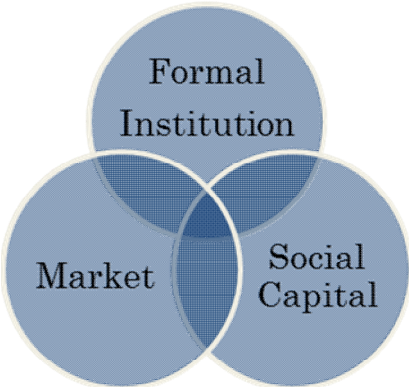

Figure 4: Components of social function

(Source: the author)

Component Proportion Ratio
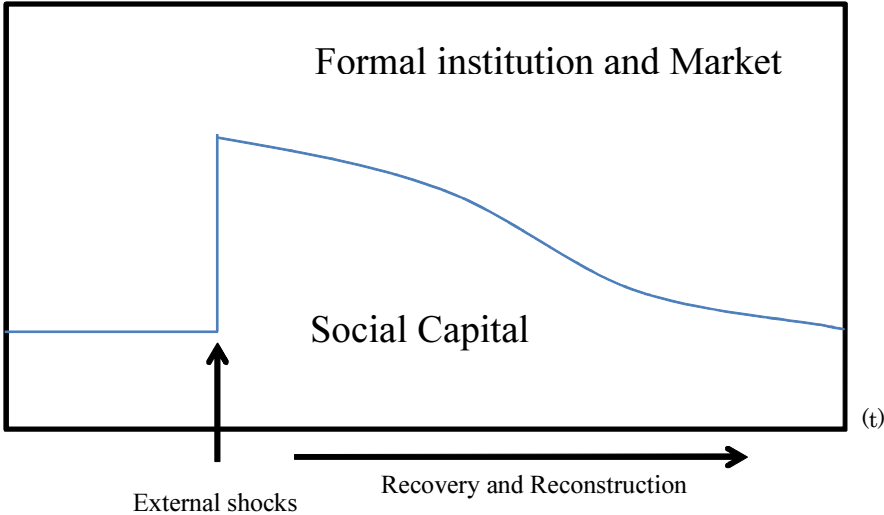of Social Function (%)

Figure 5:   Box of Component Proportion ratio of Social Function (%)

(Source: the author)

After short-term recovery, the mid- to long-term reconstruction period follows. The recovery phase aims to attain pre-disaster levels of activity, and the reconstruction phase sustains this recovery and even creates new societies. It is not possible to return everything to the way it was before. Population growth and employment are important cogs in the machine of reconstruction (fig. 6). Jobs give people an income, and local stores can then start to sell products. As a result, more people come back, and new residents move in, getting jobs and becoming members of the community. Social capital promotes job matching, reducing asymmetry of information. It also creates jobs, promoting the development of small and medium-sized enterprise, since social capital reduces transaction costs. As recovery and reconstruction progress, formal institutions and markets gradually start to function, complementing or replacing social capital.

Figure 6: The three cogs of reconstruction

(Source: the author)

To prove that social capital makes difference, first empirical study looked into what kind economic impacts do disasters have based on panel data of Japan from 1970 to 1998. Then, second study examined the role of social capital in recovery phase based on TSCS (Time-Series-Cross-Section) data of Japan from 1970 to 2009. Third study investigated the factor contributed to reconstruction of tertiary industry of Kobe after the earthquake.

Regarding the first study, there is no consensus as to whether natural disasters have a positive or negative impact. Previous literature fails to capture the heterogeneous characteristics of natural disasters. Most studies use the number of disasters that have occurred in a country as an explanatory variable. Considering the nature of most disasters, their direct impact is local rather than national. For empirical study, then, it seems to be more appropriate to use disaggregated data to capture the heterogeneous nature of disasters. To tackle these issues, this study investigates the impact of natural disasters on the growth rate of gross prefectural domestic product, utilizing the 47 prefectural governments' unbalanced panel data on Japan for twenty years from 1975 to 1995. The empirical study first investigated the relationship between "average annual per capita growth rate over the 1970–98 period" and "natural log of the number of victims." The study found a negative and statistically significant relationship. The paper employed conventional panel data analysis methods (pooling cross-sections across time, fixed effects and random effects estimation), Prais-Winsten estimation, PCSE (panel-corrected standard error) and the system GMM (General Method of Moments) since the economic model includes a lag variable, and to tackle the issue of endogeneity. Unlike several past studies, which found positive long-term effects of natural disasters, this thesis found that the impacts are robustly negative according to our analyses.

This study indicates that policies need to take a long-term view, not only in terms of recovery but also in terms of strategies for reconstruction.

The second study proved the roles of social capital in recovery phase, finding social capital proxies have positive impacts on recovery. The recovery is measured by population growth. The analysis used following data as proxies of social capital: the number of community center and proportion of households' voluntary organizing disaster prevention groups among all households. This study used TSCS (Time-Series-Cross-Section) data from all 47 Japanese prefectures covering 40 years from 1970 to 2009. With the inclusion of lagged independent variable in the estimated equation, the model could be biased. Hence, the study employed Prais-Winstein estimation and system GMM to tackle issues such as the bias, endogeneity and omitted variable.

Regarding the reconstruction phase, the third research studied how social capital worked in Kobe to promote jobs, which are a crucial cog for reconstruction, after the Great Hanshin Awaji Earthquake. This study focused on the tertiary sector because after the earthquake there have been a structural shift from secondary sector due to the damages caused by the earthquake. The sector now accounts for 80% of employment, the most important factor for reactivation in the mid- and long-term. The study found both bonding and bridging social capital had statistically significant positive impacts to promote employment in post-disaster phase.

These empirical studies also imply the necessity of putting social capital at the center of recovery and reconstruction strategies. What happened to Tohoku as a result of the earthquake, tsunami, and nuclear power accident was the destruction of social capital on a huge scale. Population is still flowing out of the area. Even before the disaster, the population of Tohoku was declining as a result of aging. Thus, Tohoku needs to face chronic problems that existed even before the disaster, and which were amplified by the external shock. Social capital should be at the core of future planning to promote the multiplier effects of investment in physical and human capital. This is the only way to reconstruct Tohoku.

Acknowledgements

First and foremost, I would like to express my great gratitude to Prof. Shunji Matsuoka, my supervisor and mentor for his guidance, great support and kind advice. He inspired me with full of ideas and enthusiasm. His constructive and critical comments all through my days during PhD research studies made me dig deeper into the theme of this thesis. When I stuck on the thesis, he gently encouraged me and gave me kind advice. He is a huge role model for me as a researcher. I found that there is still so much to learn from him. I am also very grateful to my guidance committee members, Prof. Nobuhiko Fuwa (Deputy Advisor), Prof. Kuchiki Akifumi, and Prof. Shujiro Urata, giving the constructive comments. I also wish to thank faculty members and staff members of Graduate School of Asia-Pacific Studies (GSAPS) who provide me invaluable support.

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I started this PhD study in April 2011. On March 11, just three weeks earlier, the Great East Japan Earthquake hit Japan. Due to the confusion caused by the earthquake, the tsunami, and

the nuclear power plant accident, Waseda was forced to postpone classes until May. (Prof. Matsuoka organized private seminars for MA and PhD student to keep our focus on our studies.) Initially, I was thinking to study totally different cases on social capital, not necessarily from Japan nor related to natural disasters. However, I was so shocked by the devastation caused by the disaster. My two daughters (8 and 4 years old at the time of the disaster) were also deeply shocked by the TV images of the tsunami. My elder daughter became very sensitive to any minor vibration around her. This is quite understandable since the tremor of the earthquake was huge even in Tokyo. Even many weeks after the earthquake, my younger daughter frequently went to the window to see whether any water was coming toward our house, and many times she worryingly asked me and my wife, "Mommy and daddy, the wave will not come to our house, will it?" My wife and I wondered how we could protect our daughters.

Looking back further, the Great Hanshin Awaji Earthquake hit my hometown in 1995. Seven years before the earthquake, I had already left Kobe to study and to work, but my parents, brother and relatives still lived there. Fortunately, they were all fine, and the damage to our house was relatively minor. However, since the earthquake every time I go back to Kobe, there is a strong sense of change and transformation in the city. I always feel that Kobe is a totally new place, and I do not know anything there. Even today, I have a feeling of regret and guilt that I could not do anything to help Kobe because I lived far from Kobe. One of the chapters of this thesis took up a case from Kobe. I felt this was something I must do even so many years later. The process of the study was something like rediscovering of my hometown.

Historically, there have been huge earthquakes in Tokyo, my present residence, and it is known that there is a high possibility of a future earthquake occurring near Tokyo. Actually, all sorts of disasters could occur not only in Tokyo, but also in any part of the world and to anybody. I wrote this thesis hoping that we can be resilient against those disasters in our life.

Last but not least, I would like to thank my wife, Megumi, and my daughters, Kyoko and Erika, for all their support and encouragement. My family has been the source of energy and motivation for me to complete this thesis. I would like to dedicate this thesis to them.

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Go Shimada
Waseda University
February 2014

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List of Abbreviations

CRED:	Center for Research on the Epidemiology of Disasters
DHS:	Department of Home Security
FDNY:	Fire Department of the City of New York
GMM:	Generalized Method of Moments
GDI:	Gross Domestic Income
GDP:	Gross Domestic Product
GPDP:	Gross Prefectural Domestic Product
KBIC:	Kobe Bio-medical Innovation Center
MCEER:	Multidisciplinary Center for Earthquake Engineering Research, United States
MDGs:	Millennium Development Goals
NGOs:	Non-Governmental Organizations
NPOs:	Non-profit Organizations
OED:	Oxford English Dictionary
OLS:	Ordinary Least Squares
PCSE:	Panel-corrected standard error
PTA:	Parent-Teacher Association
PW:	Prais-Winstein
R&D:	Research and Development
SC:	Social Capital
SCA:	Social Capacity Assessment
SOCAT:	Social Capital Assessment Tool
SOCAP IQ:	Social Capital Integrated Questionnaire
SMEs:	Small Medium Enterprises
SNS:	Social Network Services
TSCS:	Time-Series-Cross-Section
UN:	United Nations

UNDP: United Nations Development Program

UNISDR: United Nations Office for Disaster Risk Reduction

WB: The World Bank

Chapter 1 - Introduction

The Great East Japan Earthquake, the fourth largest earthquake in recorded history, struck Japan on March 11, 2011. The resulting tsunami was devastating – tsunamis of this scale occur only once every few hundred years – and claimed approximately 20,000 lives. Recent studies have confirmed that in the last two decades there has been an upward trend (see fig. 1-1) in the number of disasters in their economic cost and in the number of individuals affected by those disasters (Sawada et al. 2011; Hoyois et al. 2007).
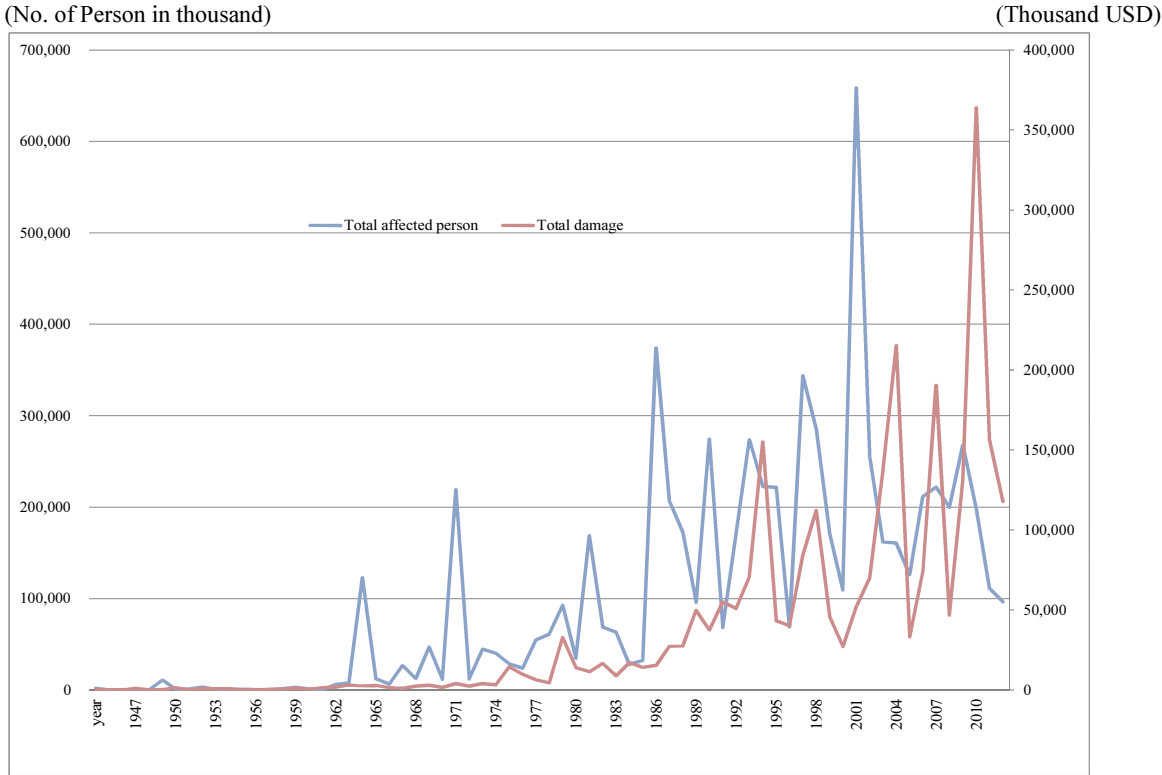
Figure 1-1: Increasing trend of natural disasters
(Source: the author based on the database of EM-DAT/CRED)

The definition of what constitute a disaster varies. The EM-DAT database, put together by the Center for Research on the Epidemiology of Disasters (CRED), includes natural disasters (e.g., geophysical, meteorological and climatological natural disasters) and technological disasters (e.g., the nuclear power plant accident in Fukushima, chemical spills and transportation accidents). Sawada et al. (2011) also include disasters such as financial crises and wars. Technological disasters, financial crises, and war can all be called 'man-made disasters.' The most vulnerable members of the population, such as the poor, children, the elderly, women and minorities, are usually hit hardest by disasters (Cutter and Finch 2008; Steinberg 2000; Cutter and Emrich 2006). This thesis focuses on natural disasters.

As the frequency of disasters increases rapidly, the need to build social resilience becomes more and more important. Resilience is the capacity to cope with external shocks and restore the previous state. How can a country or a society be resilient to external shocks? It is known that certain neighborhoods in disaster-hit regions recover more quickly than others (Edgington 2010). What, then, are the factors that make the difference, rendering a certain country or society resilient?

Views are divided regarding these factors (Aldrich 2012). Possible factors suggested have been the magnitude of damage to infrastructure (Dacy and Kunreuther 1969; Kates and Pijawka 1977), the quality of governance (Horwich 2000), the quantity of money (or aid) flowing in (Vale and Campanella 2005; Dash et al. 2000) and socioeconomic and demographic conditions (e.g., inequality) (Katz 2006).

With regard to infrastructural damage, Dacy and Kunreuther (1969: 72) argued that 'the speed [of recovery] is determined mainly by the scale of the physical damage,' which suggests the benefit of a rapid inflow of capital for reconstruction into a community recovering from a disaster. Kates and Pijawka (1977) argued along the same lines. After the East Japan earthquake, Fujii (2011) also emphasized the importance of resilient infrastructure.

Fujii later became a senior advisor to Prime Minister Abe on resilience. His argument is that infrastructural investment is the most important intervention the Japanese government can make to minimize risks and optimize recovery from disasters. Is infrastructure, then, the key factor for recovery and reconstruction after disasters?

To examine the logic of infrastructure theory, let us look at the population of Kobe before and after the Great Hanshin Awaji Earthquake of 1995. Population recovery is an essential part of disaster recovery (Aldrich 2012; Weil 2010; Davis and Weinstein 2002; Edgington 2010). Vale and Campanella (2005: 12) state that 'the numerical resilience of the population may be a reasonable proxy for recovery. For cities that have lost huge percentages of their populations, the restoration of the city as a place of habitation itself is a significant achievement.' Figure 1-2 shows the population of the nine wards of Kobe before and after the earthquake. There was a sharp population decline after the earthquake hit Kobe in 1995. The earthquake killed 6,343 people, and in total around 85,000 people left Kobe that year. It took almost ten years for the population to return to its 1994 level. As the table shows, there are four population patterns among the nine wards: 1) population declined after the earthquake, but bounced back well (Higashi-nada, Nada, Chuo); 2) population declined after the earthquake, and continued to decline (Nagata); 3) population decline was small (in other words, damage was minor) at the time of the earthquake, but population continued to decline (Suma, Tarumi); and 4) there was almost no impact (Kita, Nishi). What are the factors that contributed to this difference among the wards of Kobe?
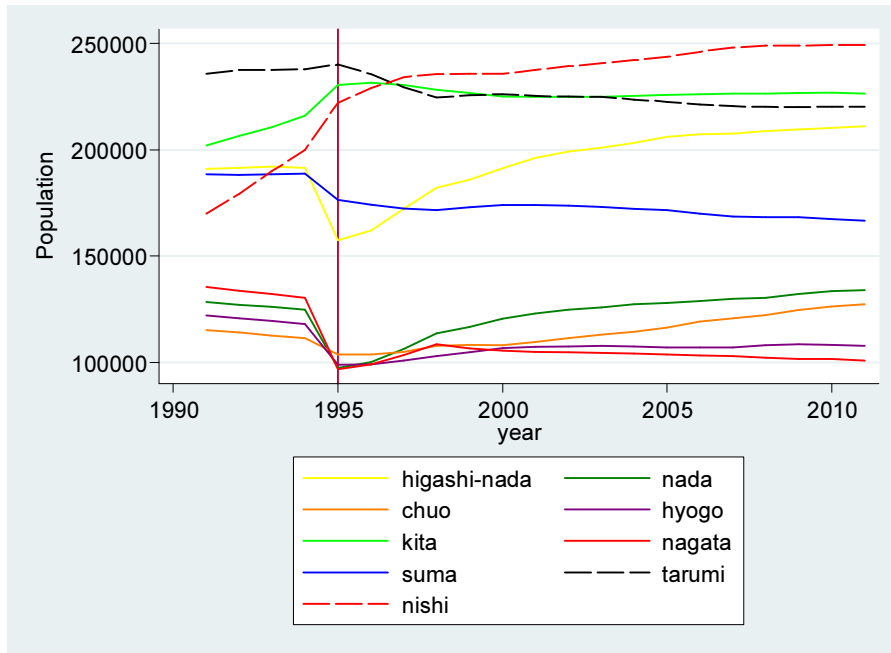
Figure 1-2: Population before and after the Great Hanshin Awaji Earthquake

(Source: the author)

Among the possible factors discussed in previous literature, three – quality of governance, the quantity of money (or aid) flowing in and socioeconomic and demographic conditions – were irrelevant in Kobe since the difference between the wards in terms of these factors is insignificant. The remaining factor is infrastructure. So was infrastructure the most important factor for recovery in Kobe?

As we will see in detail in Chapter 6, despite huge infrastructural investment in Nagata ward after the earthquake, the population continues to decline. The volume of pedestrian traffic in shopping streets in Nagata ward is also declining. In the worst case, the decline was more than 60 per cent in 2008 (thirteen years after the earthquake) in the First Avenue shopping street of Shin-Nagata compared with the pre-earthquake level. The same is true for Okujiri Island. The island was hit by a tsunami in 1993, causing damage totaling around 66.4 billion yen. The budget for recovery after the tsunami was 76.4 billion yen,

mainly for infrastructural investment. Yet in spite of this huge infrastructural investment, the population continues to decline and is around 40 per cent lower than with the pre-disaster level. Hence, although infrastructure is important, these two examples show that infrastructure alone does not contribute to recovery. What other factors, then, can be considered? The factor that this thesis considers critical is social capital – the ties and networks that bind people together. Hence, we will look into the role of social capital after disasters.[1]

After the recent East Japan earthquake, the importance of bonds (*kizuna* in Japanese) was heavily stressed, especially in the Japanese media, as fundamental to disaster prevention and recovery. Why are these bonds so important? Social capital provides a conceptual framework for understanding the importance of bonds. This thesis assumes that if social capital is high in a society, this network will provide the social safety net necessary after devastating external shocks, helping other community/network members. If this safety net is robust, then a society will be able to recover from the damage faster. Moreover, as we will see in detail in the next section, this thesis regards social capital to be important not only for short-term recovery, but also for the long-term reconstruction effort, promoting more employment opportunities.

A growing number of studies in economics and sociology have discussed the effect of social capital on economic behavior (Putnam 2000; Dasgupta, Partha, and Ismail Serageldin 2000; Putnam et al. 1993; Coleman 1988; Knack and Keefer 1997; Narayan and Pritchett 1997, Harris 1997; Fountain 1997; Levi 1996; Newton 1996; Narayan 1998; Putzel 1997; Sabetti 1996; World Bank 1997; Cabinet Office of the Government of Japan 2003,

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[1] Ostrom (2000: 202) stated as follows: 'the growth of a private sector can provide the income to build and maintain more infrastructures and public goods. It is these mutually reinforcing sets of relationships between private and public sector investments and activities that one can call economic development. Social capital plays as essential a role in achieving that development as physical or human capital. It does not represent, however, a quick fix that can be created by external or top-down processes. People who are facing extant coordination and collective action problems have to have sufficient autonomy and incentives to build their own ways of working more effectively together.'

2005). However, there is a very limited number of empirical studies on the role of social capital after disasters. This thesis aims to fill this research gap, exploring a new frontier of social capital study.

Therefore, the main research question of this thesis is: What is the role of social capital after disasters for faster recovery and reconstruction? The next chapter, Chapter 2, will review literature on social capital, and based on the review, the chapter presents three sub-questions. Chapters from 3 to 5 are empirical studies to tackle these three questions. Chapter 6 draws policy implications from these empirical studies, and concludes discussion.

Chapter 2: An Economic Approach to Social Capital

Introduction

The objective of this chapter is to present three sub-questions, identifying research gaps based on literature review on social capital. As we have seen in Chapter 1, in view of the increasing frequency of natural disasters it is an urgent task for us to build societies resilient to external shocks. How can such societies be built? This section first reviews the concept of resilience to determine the ideal conditions for resilient societies. In the following section, we will discuss how social capital, the essential 'glue' for society can contribute to building a resilient society by reviewing past literature. This chapter is intended to present an analytical framework of this thesis.

2-1 Natural disasters and resilience

In 2005 the World Conference on Disaster Reduction adopted the Hyogo Action Framework for Action (UNISDR 2005). It focused on how to build nations and communities resilient to disasters. There is growing interest in resilience in the context of post-2015 (MDGs: Millennium Development Goals) studies (e.g., UNDP 2013; World Bank 2013; Mitchell et al. 2013; CIGI–KDI 2013) as well as from academics in such fields as psychology, economics, environmental science and civil engineering (Norman 1971; Anthony 1987; Okada 2005; Norris et al. 2008; Longstaff et al. 2010; Guillaumont 2009).

The term 'resilience' has been used in different contexts and with slightly different meanings. For example, in the civil engineering field, resilience refers to how fast physical structures such as buildings and expressways can be returned to their pre-disaster condition. In disaster relief operations, it refers to how to restore civilian life. In psychology, it refers to

an individual's ability to overcome trauma. In business, it refers to a business continuity plan (BCP).

After the Great East Japan earthquake, there were calls for a more disaster-resilient Japan (GoJ 2013). However, even if people use the same words, their emphasis varies: some people emphasize the role of community (Aldrich 2012; Tatsuki 2007) and some emphasize physical toughening (Dacy and Kunreuther 1969; Fujii 2011). The differences found in proposals for how to achieve an ideal state probably come from different views of the concept of resilience. According to Aldrich (2012), the word resilience derives from the Latin *resilire*, which means 'to recoil or leap back.'[2] The *Oxford English Dictionary* defines resilience as: 1) the ability of a substance or object to spring back into shape, elasticity; and 2) the capacity to recover quickly from difficulties; toughness. Hence, there are two important components in the definition of resilience. One is capacity/ability, and the other is outcome/state based on capacity. Almost every definition of resilience includes the factor of capacity. For instance, Norris et al. (2008: 129) define resilience as the 'capacity for successful adaptation in the face of disturbance, stress, or adversity.' In reviewing several definitions, the main difference lies in the level of outcome. In the case of the *OED*, the outcome is a return to the original shape. The resilience framework (fig. 2-1) of the US Multidisciplinary Center for Earthquake Engineering Research (MCEER) is very similar to that of the *OED* in terms of outcome. MCEER defines resilience as the capacity to cope with external shocks and bounce back to the previous state. In the MCEER framework, resilience is a measure of how vulnerability can be minimized (the triangle in the figure). To achieve this, the following 4 'Rs' are crucial:

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[2] The genesis of research on resilience differs depending on the academic discipline. In psychology, it dates back to risk study in the 1970s. Garemezy Norman (1971) studied children with schizophrenic mothers and children with mothers with mental problems (but not schizophrenia). He found that even facing this risk, some children were highly adaptive and healthy. This high adaptability was the genesis of resilience study in psychology. Later, E. James Anthony (1987) used the term 'invulnerability' to capture this high adaptability. Psychological resilience has three aspects: the competence to endure even under stress; the ability to recover from traumatic shock; and the ability to overcome inequality, which tends to correlate strongly with risk factors.

robustness (inherent strength), redundancy (system properties that allow alternative options), resourcefulness (the capacity to mobilize needed resources) and rapidity (the speed with which disruption can be overcome).[3] Based on MCEER's resilience framework, Hayashi (2012) proposed three steps to strengthen resilience. These are: 1) evaluating the risk in the specific context, 2) preparing for a huge risk and 3) preparing to recover.

Quality of
infrastructure (%)

100

Vulnerability

Resilience is represented by the blue triangle. When disasters strike (t_0), damage results in diminished performance. Over time, social function is restored to its original function.

t_0 t_1 Time
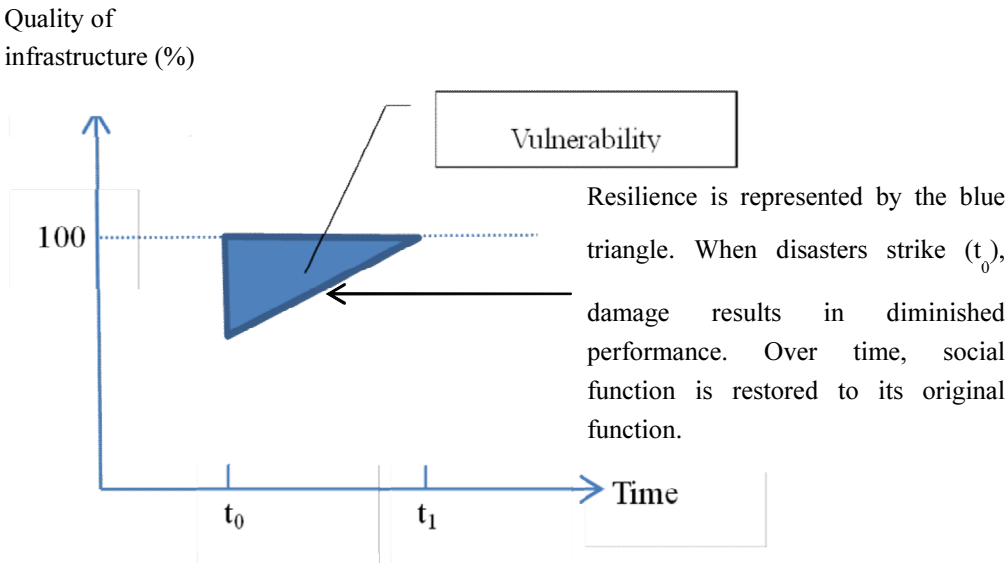
Figure 2-1: Resilience Framework
（Source: Modified by the author based on MCEER 2006）

By contrast, the UN (United Nations) definition of resilience focuses mainly on the ability (or capability) to restore basic functions, but not necessarily to restore the pre-disaster state:

'The ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.' (Source: the homepage of UNISDR 2009)

In this definition, the focus is more on the capacity side rather than the outcome. Here,

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[3] The Department of Homeland Security (DHS) of the United States defines resilience under the following 3 'Rs': robustness (maintaining critical operations and functions in the face of crisis); resourcefulness (preparing for, responding to and managing a crisis as it unfolds); and rapid recovery (returning to and/or reconstituting normal operations as quickly and efficiently as possible) (McCreight 2010).

resilience is defined as the ability of social units (e.g., government, local administrations, organizations and communities) to mitigate disasters and implement recovery activities minimizing social cost, while also preventing future disasters.

The definition of MCEER is very clear about the ideal state to be restored; however, this is difficult to achieve. Although damaged infrastructure can be rebuilt, it is impossible to bring societies or communities back to their original state. Deaths caused by disasters in the community or family are an absolute loss. The loss is unrecoverable, and cannot be compensated afterwards through any means. Even if the population or economy recovers, the community is no longer the same. For disaster-hit areas, therefore, in principle all activities after a disaster go towards recreating new societies, rather than returning to the pre-disaster state.[4]

In this regard, this thesis uses the resilience framework, but unlike Figure 2-1 the vertical axis is not 'quality of infrastructure,' but 'functioning of society' (see fig. 2-8). Furthermore, this thesis divides the post-disaster period into two stages: the recovery phase and the reconstruction phase. As discussed above, the capacity of the community is central to the dynamism required to recreate a disaster-hit area. In addition to this engine, there is the need for a direction in which it is to move. This constitutes recovery and reconstruction. This thesis includes the reconstruction phase because we should extend our thinking beyond recovery to reconstruction. The recovery phase is the short-term period directly after a disaster. This period could last from several months to several years depending on the magnitude of the disaster. Recovery essentially restores the basic functions of society in the best possible way under the circumstances (McCreight 2010). Those who had left the disaster area come back to live in the area again. One of the important indicators of recovery is population

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[4] McCreight (2010: 2) also stated: 'Resilience must be understood to embrace far more than smart mitigation practices, robust emergency response, and effective recovery operations … It means painting a realistic picture of what is required for much more than mere community survival. It must also depict what a fully restored community with essential minimums looks like.'

growth, as discussed in Chapter 1.

However, the reconstruction phase is not simply about recovering basic functions, but about recreating a new and vibrant society. The reconstruction phase is crucial to sustaining recovery and putting economic activities back on track. The reconstruction phase is a mid- to long-term process. However, reconstruction itself is a very difficult task. As we have seen in the cases of Nagata and Okujiri in the first chapter, some areas languish after disasters.[5]

The core of the reconstruction phase is job creation. Jobs give people an income to live on and spend, and local stores can start to sell products. As a result, more people come back, and new residents move in, get jobs and become members of the community. Therefore, population growth and employment are important cogs in the machine of reconstruction. These two cogs are strengthened by the capacity of the community, as we will discuss the roles of social capital in detail later, and as Figure 2-2 shows, the three cogs need to mesh together. Just, causality each of these cogs is not one way but both ways. Social capital will attract more people to come back, and if people come back it will enhance social capital of the community. It is the same to job and social capital. Therefore, the relationship among cogs is not input-output, rather it is interactive.

Until the 1990s, vulnerability was the concept used to address disaster prevention. There were a number of serious natural disasters in South America, and recovery was difficult. The cause of the difficulties was thought to be social vulnerabilities such as poverty, lack of training, limited access to social resources and education. The image of the vulnerable is that of the powerless and passive poor, an image which is not positive. By contrast with the concept of vulnerability, the idea of resilience gives these people a more positive role in the

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[5] Similar events have happened in the past. For example, the Lisbon earthquake of 1755 destroyed the city, which was at the time in the middle of the Age of Discovery. The death toll reached 60,000, and the economy never returned to its pre-earthquake level.

community.[6]

Figure 2-2: The three cogs of reconstruction

(Source: the author)

Table 2-1: Resilience and vulnerability

		Resilience	
		High	Low
Vulnerability	High	Highly vulnerable but resilient, e.g. an elderly couple living in a flood prone neighbourhoods but with health and property insurance, supporting social networks and excellent emergency services.	High vulnerability and low resilience, e.g. an isolated rural community dependent on rain fed agriculture and with few resources following previous rounds of economic or environmental stress and shock; a community beyond the reach of humanitarian and development aid, perhaps because of conflict.
	Low	Not vulnerable and with high resilience, e.g. a well-resourced family not exposed to current hazards and with sufficient capacity to enjoy flexibility in resource expenditure (i.e. savings), access to knowledge resources to plan for the future and insurance to cope with unforeseen contingencies and surprises.	Not vulnerable but also not resilient, e.g. a household not exposed to current risk, but one that has not been able or is not willing to invest in protecting the household from uncertainly and future contingencies. Investment in education and insurance and engagement in community governance and not priorities.

(Source: Edited by the author based on Sumner and Mallet 2013)

[6] McCreight (2010: 4–5) classified five dimensions of resilience after disasters. Those are: '1) personal and familial socio-psychological well-being; 2) organizational and institutional restoration; 3) economic and commercial resumption and institutional restoration; 4) restoring infrastructural systems integrity; and 5) operational regularity of public safety and government.'

Although their emphases are different, this does not necessarily mean that the concepts of vulnerability and resilience are mutually exclusive. Table 2-1 shows the combination of high and low vulnerability and resilience (Mitchell et al. 2013; Room 2000; Wood 2003). As shown by the table, even if people are vulnerable, if they are resilient it is easier for them to recover. Measures to tackle vulnerability and build resilience need to take this matrix into consideration. How, then, does social capital interact with these two factors? The next section will look into this.

2-2 Social Capital and Resilience

Social capital contributes to recovery and reconstruction through the networks and resources available to people as a result of their connections to others. In Kobe and Tohoku, after the disasters, it was observed that close bonds between relatives and neighbors led to collective action on the part of the community and the efficient allocation of the necessary resources, catalyzing communication to access assistance.[7] The collective action is considered to increase the sum of satisfaction without harming anybody. The notion of social capital provides a good theoretical base for analyzing the role of bonds. An increasing number of studies in economics and sociology have discussed the effect of social capital on economic behavior (Putnam 2000; Dasgupta and Serageldin 2000; Putnam et al. 1993; Coleman 1988; Knack and Keefer 1997; Narayan and Pritchett 1997; Harris 1997; Fountain 1997; Levi 1996; Newton 1996; Narayan 1998; Putzel 1997; Sabetti 1996; World Bank 1997; Cabinet Office of the Government of Japan 2003; 2005). However, there have been a very limited number of

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[7] Recognizing the difficulty to collaborate actually facing on the ground Ostrom (2000: 199) stated as follows: 'Instead of presuming that local users face an impossible social dilemma or collective-action problem, we are better advised to assume that it is possible, even though difficult, for those facing severe collective-action problems to overcome them. The greater the level and salience of the potential joint benefit and the existence of a supportive political system, the higher the probability that collective action will be undertaken.'

empirical studies on the role of social capital after disasters.

Social capital has been studied intensively following the early work of Glenn Loury (1977; 1981), Robert Putnam (1993; 1995; 2000), James Coleman (1988; 1990), Mark Granovetter (1973), and Pierre Bourdieu (1986).[8] The idea's genealogy goes back to Alexis de Tocqueville (2000 [1835]) and Lyda Judson Hanifan (1916). Tocqueville enthused that American citizens worked collectively to realize democracy in their new continent. Recent debate began with Glenn Loury. He rejects neoclassical arguments because for him the theory of mainstream economics focuses too much on human capital. Its image of the market is that individuals simply compete with each other on a level playing field, but this image does not explain racial income differences. Loury pointed out the inadequacies of the individualistic argument, but did not develop a concept like social capital. He paved the way for Putnam and Coleman.

The debate became active after the publication of *Making Democracy Work: Civil Traditions in Modern Italy* by Putnam et al. (1993).[9] He compared the differences between northern and southern Italy in terms of the quality of governance, and found that the stock of social capital (measured in terms of groups and clubs) in northern Italy was the factor behind success in democracy and economic development.[10] Putnam later published another important work, *Bowling Alone: America's Declining Social Capital* (2000), which is celebrated not just by academics, but by a wider public audience. Putnam had bilateral meetings with President Clinton, and was featured in *People* magazine. In this book, he discussed the declining trend of social capital in the United States, pointing out that more people were bowling alone rather than in leagues.

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[8] Portes (2000: 1) stated that: 'The concept of social capital is arguably one of the most successful 'exports' from sociology to other sciences and to public discourse during the last two decades.'

[9] Serageldin and Grootaert (2000: 45) summarized Putnam's argument on social capital as 'horizon associations.'

[10] 'Working together is easier in a community blessed with a substantial stock of social capital (Putnam et al. 1993: 35-35).'

Social capital is broadly understood as community/network relations that affect individual behavior.[11] There are many variations in its definition (Putnam 2000; Fukuyama 1999; Bourdieu and Wacquant 1992; Bourdieu 1986; Granovetter 1973; Coleman 1988; Durlauf and Fafchamps 2004; Aoki 2010). These stem from the context-specific nature of social capital and the complication of its theorization and operationalization. Despite its popularity, the concept of social capital is still controversial. For instance, Portes (2000: 1) admits, in defending the usefulness of the concept, that: "This remarkable range of applications has been accompanied by a great deal of confusion concerning the actual meaning of social capital and growing controversy about its alleged effects."[12] He classified the issues surrounding social capital into two categories. One is its application to different types of problem, and the other is theories involving different units of analysis. The following section discusses the five most important issues regarding social capital in the context of recovery and reconstruction after natural disasters: 1) networks or individuals; 2) negative externalities; 3) social capital as capital; 4) path dependency; and 5) *Gemeinschaft* to *Gesellschaft*.

In the previous literature, the role of social capital after natural disasters has not been made clear. Through discussing these issues, the following section intends to clarify this issue. The most important point is that social capital works for recovery and reconstruction together with other types of capital such as physical capital, human capital, and financial capital, enhancing the social return of investment in these areas. That is why social capital is taken up here as the key driver for resilience. Second, social capital works after disasters to complement the work of institutions and markets. In ordinary circumstances, institutions and markets work very efficiently to provide social services. However, when external shocks hit

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[11] Serageldin (1996: 196) regards social capital as 'glue that holds societies together.'

[12] Therefore, Bowles and Gintis (2002) argued that we should use the word community rather than social capital because the focus of post-Coleman period is on groups rather than individual.

societies, neither markets nor formal institutions can extend all the necessary help. People need to rely on social capital in emergency situations. Neighbors are usually the first to extend help. In the following section, this study makes clear how social capital works with markets and institutions during recovery and reconstruction. Finally, the role of social capital in economic development is summarized as a cubic equation curve with two critical points. Social capital provides the conditions for development. Then, gradually, the market replaces the role of economic development. After a certain point, as an economy shifts to become knowledge-based, especially in tertiary industry, the role of social capital again becomes very important. This is because social capital is the ground for innovation and for new added-value. As our empirical analysis in later chapter will show from case studies from tertiary sector reconstruction, this function of social capital is very important.

2-3 Controversial Issues regarding Social Capital

Network or Individual

Some authors equate social capital with trust and trustworthiness in the community, whereas others regard social capital as a product of class, and as belonging to individuals rather than communities. The former view is represented by Coleman and Putnam. Coleman (1988) argued that social capital is embedded in relationships between people.[13] In other words, his focus is on networks rather than individuals.[14] He pointed out that the social capital of Catholic communities has positive impacts on the education levels of young people in the United States. He also illustrated how close community ties aided the business transactions of diamond dealers in the orthodox Jewish area in Brooklyn, an area where people trust each

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[13] Coleman (1988: S98) defined social capital by its function but vaguely as 'a variety of entities with two elements in common: They all consist of some aspect of social structure, and they facilitate certain action of actors- whether persona or corporate actors – within the structure.'

[14] Coleman (1990: 315) stated: 'As an attribute of the social structure in which a person is embedded, social capital is not the private property of any of the persons who benefit from it' (as quoted by Narayan (1999: 6).

other.

Coleman started to focus on social capital in his quest to find out the factors that influence an individual's human capital. As we have seen above, the causal relationship in his view was that social capital has great impacts on the accumulation of human capital. On the other hand, for Putnam (1993; 1995) the causal relation is in the opposite direction. For him, human capital accumulation is the best way to foster social capital. For instance, in his view, education is the best way to encourage people to participate in volunteer activities.
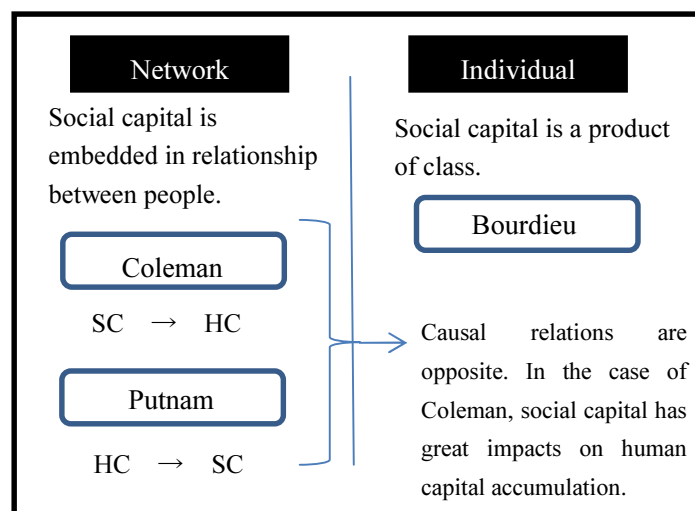
(SC: Social capital, HC: Human capital)
Figure 2-3: Diagram of thinking on social capital
(Source: the author)

The work by Putnam applied the economic concept of "stock" to the social capital of communities and nations, stressing the importance of the historical path or a legacy of long periods of historical development (Portes 2000).[15] The concept of stock is very useful in defining social capital. We will discuss this in a later section.[16] Putnam pointed out there are

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[15] Developing the idea of historical path by Putnam (1993, 1995), Krishna (2000:71) describes social capital as: 'This deterministic and pessimistic conception of social capital can be retained only by maintaining a fairly restrictive set of assumptions.'

[16] Putnam (2000: 19) defines social capital as follows: '… social capital refers to connections among individuals – social networks and the norms of reciprocity (expectations from a community to the behavior of members) and trustworthiness that arise from them … A society of many virtuous but isolated individuals is not necessarily rich in social capital.' Ostrom (2000) discussed that all forms of social capital have the same characteristics. One of those are that social capital is formed over time and it is embedded in common understanding. She (2000: 179) stated as follows: '(first) Social capital is formed over time and is

three important elements of social capital: trustworthiness, norms, and networks (Durlauf and Fafchamps 2004).[17]

In contrast to Coleman's and Putnam's emphasis on networks, Bourdieu (1986) and Bourdieu and Wacquant (1992: 119) place more emphasis on individuals: "the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition."[18] In their argument, the elites who possess social capital through fame and wealth continue to dominate society from generation to generation. In his 1985 paper, Bourdieu even stated that: "the profits which accrue from membership in a group are the basis of the solidarity which makes them possible" (quoted by Portes 1998: 3). In other words, personal connections, established through class relationships, facilitate access to various resources (e.g. jobs, investment information, closed markets, and subsidized loans). Further, Bourdieu argued that social capital makes it possible for those individuals in the network to associate with institutions that will guarantee or vouch for them, and increase their cultural capital.

Unlike Coleman and Putnam's emphasis on network, Bourdieu (1985) places more emphasis on individuals. In his argument, the elites who possess social capital through fame and wealth continue to dominate society from generation to generation. In his 1985 paper, he even stated that: 'the profits which accrue from membership in a group are the basis of the solidarity which makes them possible' (p249, as quoted by Portes 1998: 3). In other words,

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embedded in common understanding rather than in physically obvious structures; (second) Common understanding is hard to articulate precisely in language; and (third) Common understanding is easily eroded if large numbers of people are concerned or if a large proportion of participants change rapidly-unless substantial efforts are devoted to transmission of the common understandings, monitoring behavior in conformance with common understandings, and sanctioning behavior not in conformance with the common understanding (brackets are added by this author).'

[17] Fafchamps (2004) argued that trust is another form of expectation regarding another's behavior.

[18] Bourdieu and Wacquant (1992: 119) stated that: 'the sum of the resources, actual or virtual, that accrue to an individual or a group by virtue of possessing a durable network of more or less institutionalized relationships of mutual acquaintance and recognition.'

personal connections, established through class society, facilitate access to various resources (e.g. jobs, investment information, closed market and subsidized loans). Further, he argued that social capital makes possible for those individual in the network can associate with institutions that guarantee or certify them, and increase their cultural capital.[19]

In sum, Coleman and Putnam emphasize the network aspect of social capital, while Bourdieu emphasizes individual social capital rather than networks. Regarding the issue of networks or individuals, Portes (2000) pointed out that the concepts of individual asset, community asset, and national asset were never explicitly theorized.[20] Without disentangling these differences, he stated that "it risks becoming synonymous with each and all things that are positive in social life" (2000: 3).[21] He also stated that individual social capital sometimes conflicts with "collective" social capital, which he defines as civil spirit. In other words, the aggregate social capital at the community level is not always the same as the sum of individual social capital because of negative externalities. Further, an empirical study by Glaeser et al. (2002) distinguished individual social capital and community social capital, and found that individual social capital strongly correlates with human capital. As this finding indicates, it would be desirable to classify individual social capital as a component of human capital, because individuals hold this capital as a result of their life situation and experience.[22]

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[19] Portes (1998, 2000) summarized Bourdieu's concept on social capital as (1) a source of social control, (2) a source of family support, and (3) a source of resources mediated by nonfamily networks. In his 1998 article, he introduced various examples of each function. One interesting observation he introduced was by Gold (1995) on the change in parental roles among Israeli immigrant families in the United States. In Israel, in a closed community environment, adults in the community take care of children in the community. In the migrant community in the United States, where community ties lack, it is mother's responsibility to take care of children. Thus, the labor force participation of women is greater in Israel rather than the United States since close tie make possible woman to work during the day. This example shows that the decrease in the first form (social control, or community tie) is compensated by the second form (family support). As this example shows, these three forms complement each other.

[20] In spite of the differences, as Portes (1998) discussed, both Bourdieu and Coleman consider social capital as intangible and inhere in the structure of their relationship, unlike economic capital (bank account) and human capital (inside their heads).

[21] Portes (1998: 2) stated that 'In this sense, the term social capital simply recaptures an insight present since the very beginning of the discipline (sociology).' (brackets are by this author)

[22] Human capital is 'the acquired knowledge and skills than an individual brings to an activity…. Human

This thesis will focus on community social capital rather than individual social capital, as we will discuss the role of social capital in restoring social function.

Negative externalities

As Portes (2000) pointed out, social capital is not always beneficial to society. Is it only individual social capital that has negative externalities? Negative externalities come not just from individual social capital, but from other types of social capital as well. The same social capital that benefits members in privileging access to certain resources might exclude non-members from access (Portes 1998; Arrow 2000).[23] Social networks are by nature exclusive to their members; otherwise they would not be social networks (Dasgupta 1999).[24] It is well known that FDNY (the Fire Department of the City of New York) is dominated by Italian Americans, the diamond trade in New York is monopolized by Jews, and various sectors of Miami's economy are dominated by Cubans (Waldinger 1995).

Narayan (1999) provided a useful framework of analysis for understanding the negative externalities, categorizing social capital into two parts: bonding and bridging. His focus is on the social structure.[25] As Figure 2-4 shows, social capital can be "bonding" social

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capital is formed consciously through education and training, and unconsciously through experience. (Ostrom 2000: 175).'

[23] Arrow (2000: 3) stated that: '….social interactions can have negative as well as positive effects….Good behaviour spreads; so does bad.'

[24] Further, if social capital fails to develop in healthy way and fails to share norms and trust, the society will become unstable and not sustainable. Ostrom (2000: 182) stated as follows: 'Many local infrastructure facilities and public goods are, however, not provided either by public bureaucrats or private entrepreneurs but rather by those who directly receive the benefits of collective action. An example is the organization of an irrigation system by the group of farmers who will directly benefit from its operation.' If it is in the basic human sphere, it could lead to civil war such as Rwanda and Yugoslavia. If it is in economic area, it could be economic setback (Serageldin and Grootaert 2000).

[25] Uphoff (2000: 218) proposed to use two categories to understand social capital better. Those are: (a) structural and (b) cognitive. The former includes 'roles, rules, precedents and procedures as well as a wide variety of networks that contribute to cooperation (p218)' (Uphoff used the term, MBCA (mutually beneficial collective action). This definition is slightly different from that of Narayan above since he is focus mainly on network rather than institutional set up such as rules. The cognitive category is defines as it derived from culture, ideology, norms, values and attitude. The structural social capital can be observed, but cognitive social capital is not. In his paper, he stated that these two domains of social capital are intrinsically connected, but 'ultimately they all come from cognitive processes (p218).' He further stated

capital, which maintains solidarity within social groups; on the other hand, a tie cutting across groups is called "bridging" social capital. One example of bonding is family.[26] It is possible to have high bonding social capital (by which members help each other), but a lack of bridging social capital (the exclusion of members of other social groups).[27] Following on from the discussion in the last section, the figure classifies individual social capital as human capital.

Bonding Social Capital (within network)

Bridging Social Capital (between networks)

● ← **Human capital/Individual social capital**

Figure 2-4: Bonding and bridging social capital
(Modified by the author based on Aldrich (2012))
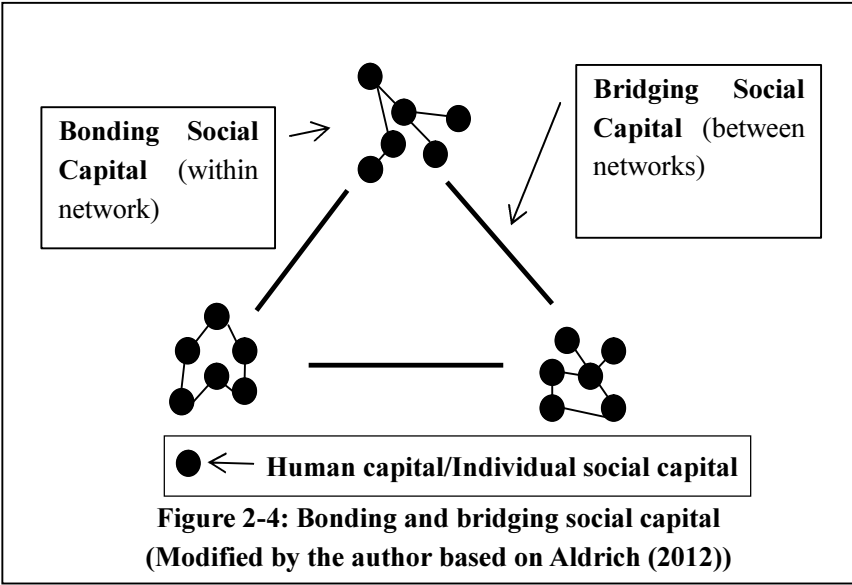
In many cases, external shocks amplify existing chronic problems and inequalities in a community such as discrimination (Olson 1982; Aldrich and Crook 2008). Aldrich (2012: 2) stated that social capital is "a double-edged sword" or "Janus-faced." This is because there is a possibility that social bonding can halt the recovery effort if the nature of a network is exclusive (e.g., the caste system, the mafia, the Ku Klux Klan).[28] Social capital can also

that: 'Not to make this (structural and cognitive) distinction reduces explanatory power and also out understanding of how social capital comes into being and is sustained (p221).'

[26] Of course, family has different meaning depending on the culture or country. Bates (1990), for example, discussed that different types of family group or social group establish different types of property rights comparing studies of Kikuru of Kenya, the Bambara of Mali, and on East African pastoralists.

[27] The concept of bonding and bridging is probably very similar to the concept of 'institutional capital' and 'relational capital' which are used by Krishna (2000) and Berman (1997). Institutional capital is defined as roles, rules, procedures, and organizations, which refers to the structural elements. Relational capital refers to cooperative elements, such as the values, attitudes, norms, and beliefs. Please refer to figure 3 in the annexure on the relationship between the two concepts.

[28] Sheri Berman (1997) also pointed out that bonding social capital does not necessary improve social

restrict personal freedom or individual behavior (e.g., a woman in purdah in northern India) (Narayan 1999). Thus, strong ties often encourage young and independent-minded people to leave because they do not like to be regulated by others. Boissevain (1974) studied village life on the island of Malta, and found that strong ties and the enforcement of norms reduced the privacy and autonomy of individuals. This is the classic dilemma, as Simmel (1969 [1902]) discussed, between social norms (or control) and personal autonomy (or freedom). These negative points should be kept in our mind, since we tend to call for more strong ties.

In this regard, Granovetter (1973) pointed out the importance of the "strength of weak ties," by which he stressed the importance of loosely knit networks working apart from the ties of the immediate circle (e.g., a small family) to serve as an informal employment referral system. His view is opposed to the common sense that the ties of the immediate circle are the most helpful in finding jobs. It is also contrary to the argument of Lin et al. (1981). Portes (1998) characterized their argument as the "strength of strong ties." Burt (1992) also emphasized weaker ties rather than dense networks because dense networks simply convey general information among members (nothing new) and oppress the flow of information. He defined social capital as: "friends, colleagues, and more general contacts through whom you receive opportunities to use your financial and human capital" (1992: 9). In the empirical study presented later, the negative externalities of social capital need to be considered regarding whether social capital hampers the recovery and reconstruction of a disaster-affected area.

Social Capital as Capital

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conditions. Ostrom (2000: 176) stated that: 'There is a dark side to social capital as well as to physical and human capital. Gangs and Mafia use social capital as the foundation for their organizational structure. Carters also develop social capital in their effort to keep control over an industry so as to reap more profits than would otherwise be the case. An authoritarian system of government based on military command and use of instruments of force destroys other forms of social capital while building its own.'

The negative externalities of social capital raise the question of why we use the term "capital" if it does not produce positive social impacts.[29] The notion that the social relations referred to by the term social capital are actually types of capital is itself problematic.[30] Arrow rejected the term on the grounds that social capital does not have the characteristics of capital, and suggested that it should be abandoned.[31] He stated that "capital" should have three aspects: "1) extension in time; 2) sacrifice of today's benefit for the future return; and 3) alienability" (2000: 4).[32] He regarded social networks as something built up for non-economic reasons rather than for economic purposes. Solow was also negative about social capital, because capital should be the result of past investment flows, whereas social capital is not.[33] Social capital, according to Solow, could simply be "behavior patterns." To be capital, it should

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[29] On this point, Uphoff (2000: 218) discussed: 'We need to remember, however, that these different categories of capital as well as subcategories are analytical rather than real. What exist are the things that are being categorized, not the categories into which they are grouped. However, making systematic and defensible distinctions among them is the most basic step toward making progress in theory and in practice.'

[30] Dasguputa and Seregeldin (2000: x) stated in the opening of the book summarizing the discussion at the renowned world bank workshop held in April 1997 on social capital that: 'The reference to 'capital' suggests that all who use the term see it as an ingredient of resource allocation mechanism. Thus, whatever else social capital may be, it is emphatically an economic good. And yet, while the term has gained wide currency, it has not found favor among economists. (underlined is added by this author)'

[31] He stated that: 'More specifically, I would urge the abandonment of the metaphor of capital and the term social capital (p4).' Further, Ostrom (2000: 174) discussed that 'Money is not capital.' This is because, in her view, money is the means to obtain physical, human and social capital. Physical capital includes infrastructure (e.g. port, road and telecommunication), tools, machines, automobiles, trucks, cattle and other animals, among other things. Serageldin and Grootaert (2000) also discussed that there are various aspects of social capital, and it is the same to physical capital, which also have divergent aspects such as machines, factories and transportations are all physical capital, but the nature is different. Thus, they argued there are also different aspects of social capitals. Ostrom (2000: 174) further stated that: 'Money, like many other resources, can alternatively be used for consumption or sit unused as a store of value. Many types of capital can be created without money, or with very little of it, based on the time and energy spent by individuals in building tools and facilities, learning skills, and establishing regularized patterns of relationships with others. All human-made capital involves creating new opportunities as well as exercising restraints, a risk that the investment might fail, and the possibility of using capital to produce harms rather than benefits.'

[32] Arrow (2000: 4) even stated that: 'I certainly found no consensus at the workshop for adding something called 'Social Capital,' to other forms of capital. Regarding the definition of capital, Bates (1990:153) stated that: 'People form capital when they withhold resources from present consumption and use them instead to augment future consumption (or production) possibilities' (as quoted by Ostrom 2000).

[33] Solow stated that: 'to sum up, I am critical of the concept of social capital and the way it is used' (p6). 'Just what is social capital a stock of? Any stock of capital is a cumulation of past flows of investment, with past flows of depreciation netted out. What are those past investments in social capital? How could an accountant measure them and cumulate them in principle? I am not now worrying about where the numbers would come from, I am wondering what instructions you would give a search party (Solow 2000: 7).'

constitute a "stock" of production factors that would produce goods and services over a period of time. Solow also pointed out that "behavior patterns" may have not only positive impacts on economic performance, but also negative impacts, and hence they cannot constitute capital in the same sense as physical capital.

Although Arrow was critical of the concept, he admitted that social capital could contribute to economic performance. Durlauf and Fafchamps (2004: 3) noted: "Even if a precise definition of social capital were attempted, it is likely to be no less vague than other similar concepts … This kind of vagueness, however, is less problematic as long as researchers agree on some basic principles."[34] Although there is debate among researchers about definitions, nobody rejects the idea that ingredients of social capital such as trustworthiness, networks, and norms are important.[35] Solow (2000: 6) stated: "That does not mean I think the underlying ideas are unimportant or irrelevant to economic performance. On the contrary, I think that those who write and talk about social capital are trying to get at something difficult, complicated, and important: the way its economy works. It is a dirty job, but someone has to do it." [36]

How, then, are we to define social capital in this thesis? If we define social capital as

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[34] Further, depending on the disciplines, the meaning differs. Social capital is generally referred as the set of norms, networks and organizations in various social sciences field such as sociology and political science. In Economics, in addition to the said definition, they focused on the contribution to economic growth (macro) and improve market function (micro) (Serageldin and Grootaert 2000). Dasgupta and Serageldin (2000: x) also stated: 'Some author have identified social capital with such features of social organization as trust. Then there are those who think of it as an aggregate of behavioral norms. Some view it as social networks, and there are those who think of it as a combination of them all. So it would see that social capital means different things to different people'

[35] Uphoff (2000: 216) stated as follows: 'What constitutes social capital cannot be settled simply by offering a definition since definitions, while needed, offer no solution. Two hundred years ago, we could hardly have discovered what constituted physical capital simply by agreeing on how to define it. <u>Cumulative empirical work guided by analytically coherent concepts will be needed to produce a robust understanding of a phenomenon as complex as social capital.</u> (underline is added by this author)'

[36] Solow (2000) further stated that: 'My problem is that I would like to see the job done well, in the hope that serious research will uncover defensible answers.' Putnam (2001: 1) stated: 'among the people who are working in this field, there has been a visible convergence.' He suggested that researchers should think about the multiple dimensions of social capital. Portes (2000: 4) also stated that: 'The theoretical problems in the formulation of the concept have been partially compensated by subsequent efforts at measuring it empirically.'

trustworthiness, norms, and networks, as Putnam and many sociologists did, then it is difficult to regard social capital as capital because it can include negative externalities. Within the context of an economic approach to social capital, this thesis considers trustworthiness, norms, and networks as capital only if there are positive impacts on economic performance. In other words, social capital is considered as a factor of production.[37]

As discussed earlier, this thesis uses the economic concept of "stock" to define social capital, following the argument of Fisher (1906). He used the concept of "stock" and "flow," with stock as capital (wealth) and flow as income (Morotomi 2010; 2003). He stated that:

The distinction between a fund and a flow has many applications in economic science. The most important application is to differentiate between capital and income. Capital is a fund and income a flow. This difference between capital and income is, however, not the only one. There is another important difference, namely, capital is wealth, and income is the service of wealth. We have therefore the following definitions: A stock of wealth existing at an instant of time is called capital. A flow of services through a period of time is called income. (1906: 52)

Hence, social capital can be defined as the stock of trustworthiness, norms, and networks without negative externalities. The amount of stock is not fixed. It can be increased or decreased as stock is added or destroyed. As we will see in the section on the present status of Tohoku, population is still leaking to other areas. In this kind of situation, the stock of

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[37] This idea is very close to Stiglitz (2000). In Stigltiz's view, social capital has four distinct aspects. Those are: 1) social capital is tacit knowledge and a means of production which takes time and efforts to produce (opportunity cost); 2) social capital is a collection of networks (social groups); 3) social capital is a way to sort out reputation as well as aggregation of reputations, which could reduce transaction cost; and 4) social capital includes the managerial capital that managers have developed (their style of command, administrations, incentives and marketing, among other things). He further discussed that there is no presumption that evolutionary processes always lead to optimal properties.

social capital erodes.

Further, social capital works together with other types of capital.[38] These are physical capital, human capital, financial capital, and natural capital. Looking back through the history of economic thought, at the beginning of economic development privately owned finance was considered as primitive accumulation of capital (Morotomi 2010; 2003). As economies developed over the twentieth century with industrialization, private capital began to require huge public investment in infrastructure such as railways, roads, and telecommunications, which is difficult to finance privately. Physical capital itself does not create the flow of services.[39] The services are created through use. To be used, physical capital should align with the demand of the area or it should create demand. If physical capital is connected with the social capital of an area, it will enhance the benefits of the physical capital to the area and increase the well-being of society. In other words, physical capital will benefit not only a section of the society, but the whole society. This will happen only if

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[38] Physical capital can be defined as the stock of human-made material resources to be used for future productive use (Lanchmann 1978). Regarding physical capital, Ostrom (2000174) further discussed that: 'The construction of physical capital involves establishing physical restraints that (a) create the possibilities for some events to occur that would not otherwise occur (for example, channeling water from a distant source to a farmer's field), and (b) constrain physical events to amore restricted domain (for example, water is held within a channel rather than allowed to spread out). Thus, physical capital opens up some possibilities while constraining others. The intention to construct useful physical capital is not always fulfilled. An investment in physical capital may not generate the improved flow of future services. A new but crumbling roadway or irrigation system, or an empty building, represents a failed investment decision. Physical capital may have a dark side and generate more harms than benefits. Investing in a weapons facility increases the quantity of physical capital existing at a particular point in time, but the product of this form of physical capital is the threat of human destruction. Even investments in the production of consumer goods can produce substantial externalities. A nuclear power plant that leaks radioactive materials, for example, is constructed in order to increase the availability of power for positive purposes but may produce more negative externalities than the net benefits generated. Physical capital cannot operate over time without human capital in the form of the knowledge and skills needed to use and maintain physical assets to produce new products and generate income. If physical capital is to be used productively by more than one individual, social capital is also needed.'

[39] Regarding the differences between physical and social capital, Ostrom (2000: 173) examined it as follows: '1) social capital does not wear out with use, but rather with disuse; 2) social capital is not easy to observe and measure; 3) social capital is hard to construct through external interventions; and 4) national and regional governmental institutions strongly affect the level and type of social capital available to individuals to pursue long-term development efforts.' Ostrom (2000) further stated that: 'Human capital consists of the acquisition of new capabilities as well as the learning of constraints. Learning a new language opens up different conceptions of the world.'

physical capital is linked with social capital, because it will increase the social return of the investment. The same is true of other types of capital. The stock of natural capital will be preserved and used in a sustainable way if it is connected with social capital, avoiding the tragedy of the commons. To increase the social rate of return, not just the economic rate of return, social capital is key. As the following figure shows, social capital will strengthen the social return through linking with other types of capital. Social capital has been neglected in economics literature, and considered just as a residual function. This thesis regards social capital as a factor in shifting the production function upwards.
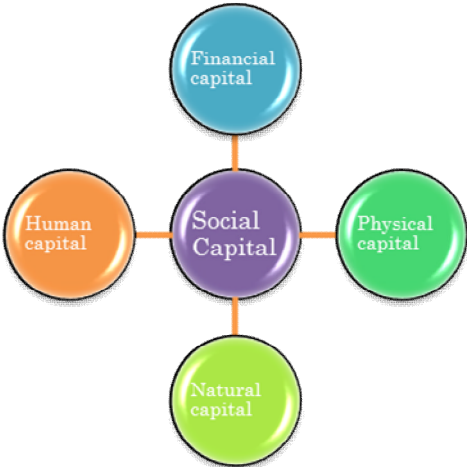
Figure 2-5: Social capital enhances the benefit of other types of capitals
(Source: the author)

Path Dependency

Putnam (1993, 1995) stated that the historical path decides the present level of social capital, and determines the situation of the present society.[40] Putnam's view is echoed by Locke

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[40] In this regard, Krishna (2000: 72) stated that: 'Social capital, they (Putnam, Leonaridi, and Nanetti, 1993) claim, is a legacy of long periods of historical development. Present generations cannot add productivity to their inherited stock of social capital, definitely not in the short run. Thus, societies are condemned to live with the fruits of their inheritance. If rich in social capital, they will develop fast; if their forebears have left behind a depleted stock, then these societies will develop only extremely slowly.... Faced with a low social capital setting, the development practitioner might as well pack his or her bags and go home. Nothing these practitioners or their clients can do will change what history has in store for them.'

(1995) and Fukuyama (1995).[41] This leads us to question whether we can promote or enhance social capital if history is the main factor. Furthermore, if social capital is deterministic (or pessimistic), there are no policy implications for recovery and reconstruction after disasters.

Against the deterministic view, Glaeser et al. (2002) provided us an opposite case study. They employed a simple model of investment in social capital, which is identical to the standard model of investment in physical and human capital.[42] They found that social capital accumulation patterns are consistent with the standard economic investment model. 1) As people age, social capital rises, then, as they get old, it falls; 2) an increase in mobility decreases social capital; 3) individuals who have jobs for which social capital is important try to accumulate social capital; 4) homeowners have more social capital; 5) physical distance reduces social capital sharply; and 6) people who have higher human capital also have higher social capital. These results show that the stock of social capital is not stable or not path dependent, but can change depending on the situation. This point is important because it means that the concept of social capital is not deterministic and that social capital can be fostered. This point has been supported by other empirical studies (Schneider et al. 1997; Lam 1996; Ostrom 1994).[43]

Gemeinschaft to Gesellschaft: *Social Capital and Institutions*

Regarding the importance of social capital, do we insist that we should go back to *Gemeinschaft* rather than move to *Gesellschaft*? Further, how do we consider the relation between formal institutions and social capital? No society is either purely *Gemeinschaft* or *Gesellschaft*. The balance between the two is essential. Serageldin and Grootaert (2000)

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[41] Fukuyama (1995) also regards social capital as a product of inherited property and fixed in culture.

[42] Ostrom (2000: 174) stated that: 'Investment in physical capital are usually a self-conscious decision, while human and social capital may be developed as a by-product of other activities as well as purposely.'

[43] Schneider et al. (1997: 91) stated that: 'the design of the institutions delivering local public goods can influence levels of social capital....government policies can and do affect the level of social capital' (as quoted by Krishna (2000: 72).

argued that the appropriate level of social capital differs depending on country and period. This argument is in line with Stiglitz (2000).[44] Stiglitz stated that as a society develops, social capital needs to change, substituting or replacing interpersonal networks with formal institutions of the market economy such as a system of laws, rules and Webbehan bureaucracy.[45] In this regard, Stiglitz pointed out that the concept of a social network is slightly different from that of citizenship (or community trust) which is far more inclusive. He also stated the possibility of social progress "from a society ruled by mutually exclusive groups to one that aspires to be ruled by citizens, hopefully through democratic forms of representation."[46]

The change, which Stiglitz pointed out, is considered as a transformation from *Gemeinschaft* to *Gesellschaft*.[47] Arnott and Stiglitz (1991) introduced an interesting model taking an example from insurance and risk-sharing. People have choices regarding insurance. One is market-based insurance, and the other is non-market insurance such as marriage (in which a husband and wife help each other). The cost of market-based insurance is less since private insurance companies can hedge their risks much better than families. What then is the optimum for the economy? If non-market insurance crowds out market-based insurance, it is not optimal. It is not effective for risk-sharing because it is provided on an individual basis and can be dysfunctional as well. That is why Stiglitz (2000) stated that, as an economy develops, its social capital must adapt, allowing the formal institutions of a market economy to replace informal arrangements. Stiglitz described this as "an inverted U-shape

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[44] Stiglitz (2000: 60) discussed that: 'The market value of a firm typically exceeds by a considerable amount the value of its physical assets and the human capital that is attached to the firm. Accountants call this capital 'good will,' but it is, I think, closely akin to what many of us think of as social capital.'

[45] Stiglitz (2000: 59) stated: 'This process may initially involve a depletion in the overall level of social capital, in which social relations are embedded in the economic system, rather than *vice versa*.'

[46] Stiglitz (2000: 66) further stated that: 'Moreover, there is progress in moving from group-based to market-based participation.'

[47] Stiglitz (2000: 65) described this changes as follows: 'This has been characterized as a change from a situation in which economic activity is embedded in social relations, to one in which social relations are embedded in social relations to one in which social relations are embedded in the economic system. This change is not uniform across the world, nor is it ever complete.'

relationship." Initially, the level of economic development increases as the density of social capital increases. In other words, social capital provides the conditions for development. After a certain level of development, the role of social capital decreases as the roles of the market and formal institutions increase.[48]

This inverted U-shape curve is appropriate for developing countries and the most emerging economics. After a certain level of development, however, it has been observed that social capital regains its importance in giving value to products, especially in tertiary sector. Developed economies are now turning more and more toward a knowledge-based economy (or immaterial economy), unlike traditional industrial countries. For instance, technology companies such as Apple do not have factories in the US. Their main income comes from content rather than hardware. It would more appropriate to say that they produce hardware like the iPhone in order to sell content. The same is true of Amazon's Kindle device. In these knowledge-based economies, the role of social capital becomes more important than in traditional modern industrial economies. Saxenian (1994) compared the success of Silicon Valley on the west coast of the US and the decline of Route 128 on the east coast. Based on the case studies, she concluded that the difference came from the social capital of the two regions. Silicon Valley had a richer social capital that enabled companies to flourish, surpassing the advanced region of Route 128. This is the case not only for the high-tech field: in the field of tourism, many areas now try to attract tourists not just through monuments, ruins, and heritage, but through regional features and community life. That is to say, expanding on Stiglitz's inverted U-shape curve, the role of social capital again becomes crucial after a certain level of development. The relationship between social capital and

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[48] Stiglitz (2000: 64) stated that: 'Early on in the development of market economies, when markets are thin and incomplete, a thick network of interpersonal relations functions to resolve the allocative and distributive questions. Especially when the scale of the organization is relatively small, the system works reasonably well: in some cases, the principal can directly supervise the agent; in others, there are social mechanisms that induce agents to monitor each other. Peer monitoring is a good example of collective mutual monitoring.'

economic development has a cubic equation curve with two critical points, as shown in the following figure.
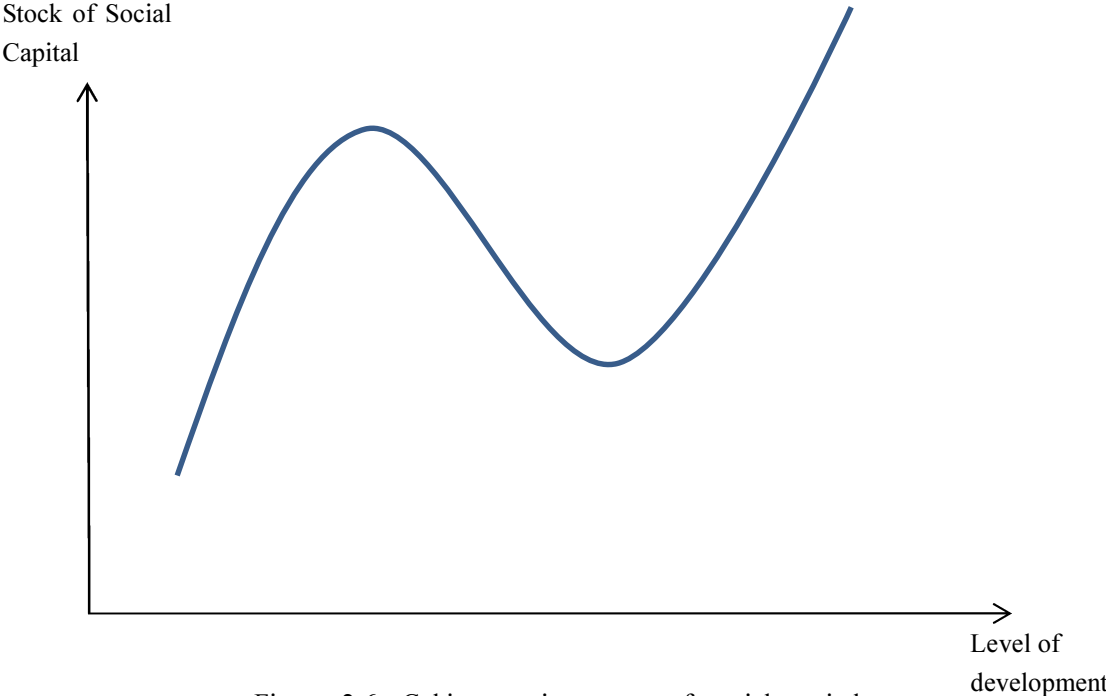
Figure 2-6: Cubic equation curve of social capital
(Source: the author)

After natural disasters, very similar scenarios to the insurance case detailed above occur. Soon after a disaster, huge amounts of relief supplies and volunteers flow in. This quick response is very important since it is difficult for governments and markets to respond to natural disasters and to provide the necessary help efficiently. Informal assistance helps the affected society to recover social function quickly. However, in mid-long term, if this aid remains it could crowd out private-sector activities and hamper healthy market recovery. As time goes by, the market needs to function to play its role in recovery, providing necessary goods and job opportunities for the victims of disasters.
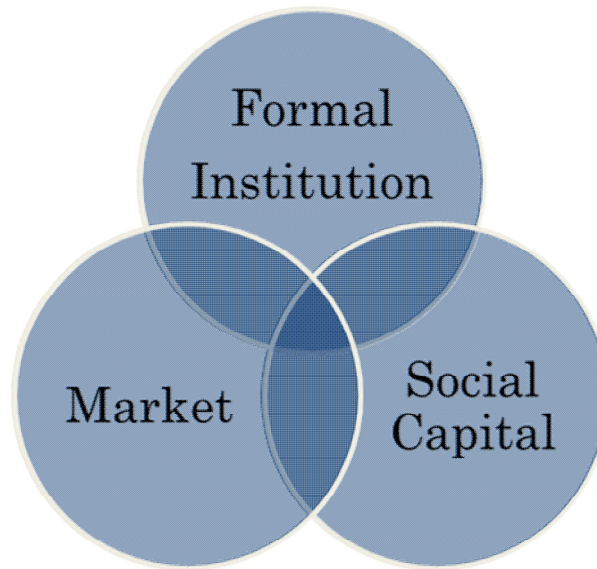
Figure 2-7: Components of social function
(Source: the author)

As there is no pure *Gemeinschaft* or *Gesellschaft* society, the social function consists of
institutions, markets, and social capital (figure 2-7). Institutions and social capital are closely
associated with each other. Institutions include political regimes, governments, court systems,
rule of law, and bureaucracy (North 1990; Olson 1982).[49] The institutional approach has been
studied by North (1990), Aoki (2010), and Ostrom (2005), among others.[50] Matsuoka (2009)
compared the definitions of institutions made by these three authors, and argued that their
definitions were similar, since institution implies a variety of actors forming a society by
interacting with each other through formal (legal) and informal (traditional rules and social
norms) structures.

North and Olson stated that per capita distribution of "traditional" productive factors
(e.g. land, financial capital, natural resources, and technology) cannot fully explain the
existence of inequality in per capita incomes. In their view, institutions and social capital are

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[49] The rule of low and court system reduces uncertainty and transaction costs if works well such as contact.
[50] The definition by Ostrom (2000: 176) on social capital is slightly different from others shedding light on
interactions and recurrent activities. The definition is as follows: 'Social capital is the shared knowledge,
understanding, norms, rules, and expectations about patterns of interactions that groups of individuals bring
to recurrent activities.' Ostrom (2000: 173) stated on social capital as: 'It is important that social capital be
taken seriously and not allowed to be carried off as a fad.'

the factors that determine the differences.[51] How, then, do social capital and institutions interact with each other? North (1990) views institutions as "the rules of the game" (1990: 3) in a society that form the way people behave. Ostrom's perspective is similar, as she defines institutions as rule-structured situations, which assist individuals to act collectively as communities or networks to tackle the problems they face.[52] One example she provided was irrigation systems, which are organized and maintained by thousands of farmers all over the world (Ostrom 2000). She stated that farmers always face collective action problems in determining issues such as the sharing of the costs of construction and maintenance, the distribution of benefits among participants, and punishing those who cheat other members. She stated that convention alone is not enough to achieve collective action because it is relatively difficult to overcome the temptation to cheat without monitoring, more self-consciously developed agreements, and sanctions.[53] She analyzed how farmers themselves bargain over rules. In her view, institutions and conventions evolve as a result of past interactions such as shared expectations and collective behavior. "If mutual expectations based on past behaviour are fulfilled again and again, the precedent becomes a convention for

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[51] Uzawa (2005) proposed a broader concept, 'social common capital,' which provides services and institutional arrangements to maintain human and cultural life. Social common capital has three components: natural capital, social infrastructure (e.g., roads, electricity), and institutional capital (e.g., governance systems, judicial systems, public administration services, hospitals). Social common capital is held not as private property, but as common property. It is not managed by bureaucracy or by private institutions. Hence, the institutional arrangement of commons is of crucial importance for sustainable natural capital management. Uzawa uses the term 'institution,' following Veblen (1899, 1904), to mean the rules of the game that impose norms to members of society what to do or what not to do. In his view, these rules are determined by the interplay of the inherited conditions of society, culture and nature, which change along with the process of economic development. Institutional capital also includes social capital. Developing Uzawa's concept of social common capital in line with recent developments in institution theory, Matsuoka and Komatsu (2007) proposed the Social Capacity Assessment (SCA) to analyze institutional development, under which social capital is part of an institution. To be more precise, the SCA is designed to analyze the social capacity of stakeholders and the interactions between all the social actors. It defines three stages of institutional development: 1) the system-making stage; 2) the system-working stage; and 3) the self-management stage. These three stages give us the perspective to assess the capacity of institutions, and also to make policy plans for future actions to strengthen this capacity.

[52] Ostrom (2000: 184) discussed that: '.... an agreement is successful not simply because it creates joint benefits. It is successful when those who contribute to its continuance expect net benefits for themselves and their families that are greater than the alternatives available to them.'

[53] The rules should, in her view, contain rules of punishments as a negative incentive for members of a community and a network to follow the rules (Ostrom 2000).

how activities, cost, and benefits will be handled by individuals in the future" (Ostrom 2000: 177).[54]

In the same vein, Aoki (2010) also proposed the notion that institutions are formed by strategic interactions by economic entities, drawing on his game-theory-based comparative institutional analysis. The social capital of a community or a network is established by previous games, and will be used in later games. In his argument, social capital is considered as a Nash equilibrium since it is absolutely necessary for community members to take part in it (consider, for example, the ostracism, murahachibu, of the Edo period in Japan). Narayan (1999: 12) stressed the dynamic interaction of rules and norms between the state, the political system, and social organization including formal institutions such as the law and the courts. Over time, dynamic interactions affect each person and change each person.[55]

Regarding the relationship between social capacity and institutions, Matsuoka (2009) argued that there is an interaction between the two because institutions have two distinct aspects: one is regulating people's behavior; the other is expanding the possibilities for people's behavior. These two characteristics facilitate an interactive connection with social capacity. That is to say, social capacity forms institutions, and at the same time, as social

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[54] Ostrom (2000: 178) stated that 'Conventions may be established without as much collective, self-conscious thought as is involved in creating new rules or establishing new entrepreneurial opportunities. Individuals facing a particular opportunity or problem in a specific location and time decide to handle it in a particular manner. That decision becomes a precedent for arriving at a similar agreement when a related opportunity or problem is faced again. If mutual expectations based on past behavior are fulfilled again and again, the precedent becomes a convention for how activities, costs, and benefits will be handled by individuals in the future. The convention has economic value because transaction costs are much lower when most participants already have agreed that a particular convention is appropriate and positive gains can be achieved with a low risk of breakdown.'

[55] Ostrom (1998) stressed the importance of norm because it will make people possible to achieve better results than wituout it. Ostrom (1998: 177) stated that: 'The norm of reciprocity implies some level of symmetry among those who engage in long-term reciprocal relationships. When individuals learn to trust one another so that they are able to make credible commitments and rely on generalized forms of reciprocity rather than on narrow sequences of specific quid pro quo relationships, they are able to achieve far more than when these forms of social capital is not present.' Oakerson (1993: 143) also stated that: 'In a reciprocal relationship, each individual contributes to the welfare of others with an expectation that others will do likewise, but without a fully contingent quid pro quo.'

capital develops, institutions also change.[56]

As has been discussed, social capital, institutions, and markets interact and complement each other as components of social function. The appropriate balance among these three factors differs depending on social conditions such as the level of development and the external shocks suffered. After a disaster, it is a challenge for any government (formal institution) to provide the required help. The same is true for the market. Because of various disruptions (e.g. damage to offices and transportation) and sudden huge demand from disaster-affected people, markets cannot work properly and effectively in the initial emergency phase after a disaster. Figure 2-8 shows how those three factors work before and after external shocks and throughout the recovery and reconstruction phase. The vertical axis shows the component proportion ratio of social function. The upper end is the total social function a society needs from formal institutions, markets, and social capital. The horizontal axis shows time. From left to right it moves from the normal situation, through disaster, recovery, then reconstruction. The left side shows that, in normal conditions, the role of social capital compared with institutions and markets is relatively small. However, when disasters occur, relative to the emergency needs of society the role of formal institutions and markets is small. People rely on social capital in emergency situations. For instance, without information from neighbors, it is difficult for emergency workers to identify those who need immediate help such as seniors and disabled people. In many cases, neighbors are the first to extend help to those people. Then, in the process of recovery and reconstruction, institutions and markets gradually start to function, complementing or replacing the role of social capital. The most important point is that a larger role has to be played by social capital until disaster-affected

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[56] Matsuoka concluded that institutional changes should be clearly specified in the definition of capacity development, advocating a new approach: 'capacity development and institutional change.' As part of this new approach, Matsuoka proposed that the SCA – including Actor-Factor Analysis, Path Analysis and Development Stage Analysis – be used to investigate a group of institutions that constrain social actor activities. The SCA is a practical methodology to be used in actual strategic planning, enabling policy planners to understand the current status and problems of institution and social capacity.

societies fully recover. Later, we will examine how exactly social capital works during the recovery and reconstruction phases.

Component Proportion Ratio
of Social Function (%)
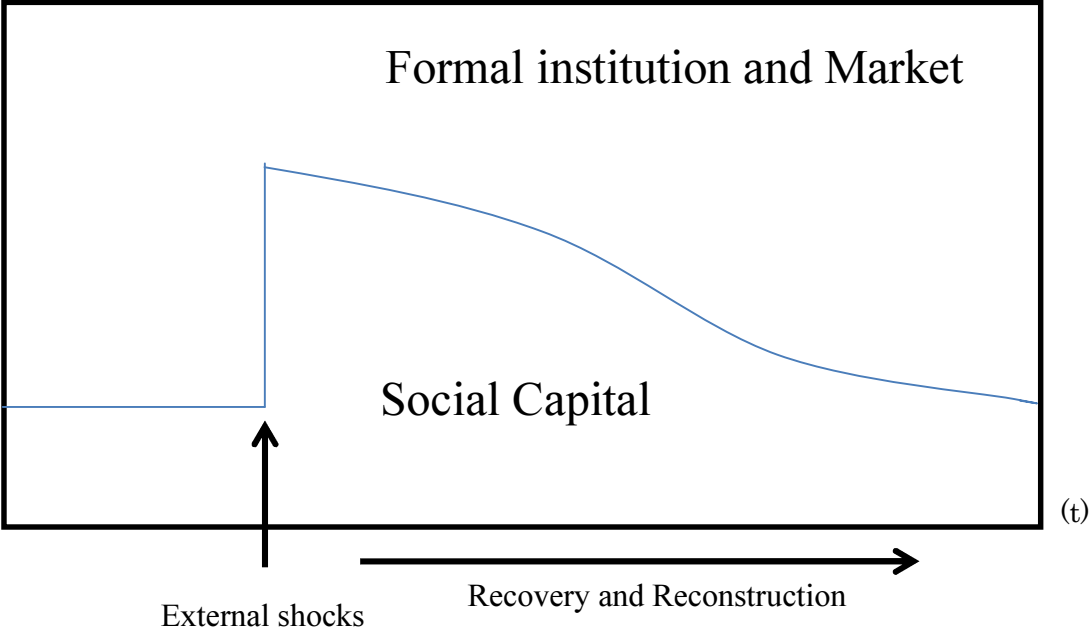
Figure 2-8: Box of component proportion ratio of social function (%)
(Source: the author)

This section has discussed five issues related to social capital with regard to disasters. In discussing these five points, we have tried to come to a definition of social capital. In summary, there are various aspects. First, social capital is the key to increasing the social return of investment in physical capital, financial capital, human capital, and natural capital. Second, social capital works in the post-disaster period to complement formal institutions and markets until disaster-hit areas fully recover. Third, the relationship between social capital and economic development has a cubic equation curve. Initially, social capital is the key to increasing development. As economies industrialize its role is gradually replaced by formal institutions and markets. After a certain level of development, social capital regains its importance in adding value to products. Fourth, individual social capital is best classified as a

component of human capital. This thesis focuses only on community/network social capital.

Fifth, communities/networks are considered as capital only if there are positive impacts. As a concept, the negative externalities of social capital are not capital, in the same way as negative environmental externalities, which are caused in the process of production. Sixth, as past studies have shown, social capital is not path-dependent. The stock of social capital can be added to or destroyed by internal or external forces. There are possibilities for promoting social capital by policy interventions. Based on the above discussion of social capital, the next section discusses in detail how social capital works after natural disasters in the recovery and reconstruction phases.

2-4   *How Exactly Does Social Capital Work after Natural Disasters?*

How can social capital contribute to the well-being of society? This section begins by discussing its role in society, before focusing on its role in terms of responding to natural disasters in the recovery phase and the reconstruction phase. Social capital is critical because the market without it is considered not to be Pareto efficient, as Durlauf and Fafchamps (2004) and Stiglitz (2000) have discussed. The role of social capital is to increase Pareto efficiency, filling the gaps left by markets. Many economists consider that social capital makes up the deficiencies in the market. Certainly, in the presence of market failures such as imperfect information and enforcement, externalities, free riders, the tragedy of the commons, or the prisoner's dilemma, social capital is one way to achieve Pareto efficiency (though not the only one).[57] As Putnam et al. (1993) discussed, social capital contributes to overcoming collective action problems, making it possible for communities or networks to choose a better

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[57] Durlauf and Fafchamps (2004) discussed three conditions under which social capital could raise Pareto efficiency through information sharing: 1) imperfect information being the source of inefficiency; 2) there being existing incentives for the spread of erroneous information; and 3) there being no obstacle to Pareto efficiency other than asymmetry of information. They also pointed out that there is no guarantee that accurate information will be transferred through a social network unless there is also a punishment mechanism, such as reputation risk, legal or extra-legal penalties or guilt (Fafchamps 1996; Platteau 1994).

option among the possible multiple Pareto-ranked equilibriums. People who collaborate accomplish superior results reducing the required amount of inputs. In the context of a social dilemma or collective action, individuals tend to maximize short-term benefits, which render them worse off compared with the option of joint-collaboration activity (Ostrom 2000). In other words, the issue of public good needs to be decided collectively rather than individually (Serageldin and Grootaert 2000).[58] It is well known that uncoordinated or opportunistic behavior by economic agents will cause market failure. For instance, irrigation projects fail if there is no formal or informal means to impose norms regarding sharing the water (Ostrom 1995; Meinzen-Dick et al. 1995). Social capital is the key to this problem. This can be achieved through such means as selective incentives (rewards), social pressure (criticism and ostracism), and surveillance (visible oversight of members) (Serageldin and Grootaert 2000; Dasgupta 1988; Aldrich 2012).

There are three possible mechanisms through which social capital can achieve Pareto efficiency (Durlauf and Fafchamps 2004; Aldrich 2012). These are: 1) opening access to information and knowledge to individuals in the group, and promoting information exchange on technology (reducing asymmetry of information and enforcement); 2) resolving coordination failures of economies which have multiple Pareto-ranked equilibriums (avoiding free riders and the tragedy of the commons); and 3) building new norms among network members to give incentives to individuals to choose a socially superior equilibrium (prisoner's dilemma).[59]

Take the example of imperfect information; one important role of social capital is to

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[58] Serageldin and Grootaert (2000: 49) discussed that: '(Collective decision-making) is one of the basic rationales behind the notion of government. But like government, local and voluntary associations do not always effectively maximize their ability to make collective decisions. The extent to which they do depends not only on how well they address the problems of institutions are more effective at enforcing common agreements and cooperative action when the assets are distributed relatively equitably and benefits shared equally.'
[59] Routledge and Amsberg (2003) defined social capital as a cooperative equilibrium in terms of the prisoner's dilemma.

decrease the asymmetry of information, as Hayek (1945) and Stiglitz and Rothschild (1976) pointed out. As a result of such a market failure, agents will not be able to find each other efficiently (not Pareto optimal).[60] Social capital can address this market failure and improve social exchange through networks (Hayami 2009). Stiglitz (2000: 59) interpreted social capital as "a social means of coping with moral hazard and incentive problems." As Serageldin and Grootaert (2000) noted, the high performance of the East Asian "miracle" economies cannot be explained by factors that neoclassical economics emphasizes, such as investment in human and physical capital and technology. They argued that East Asian countries invested in social capital by creating an enabling environment for economic growth (e.g. institutional arrangements and organizational designs to enhance efficiency, to promote public–private partnerships, and to promote exchange of information).

On the other hand, because of imperfect information, traditional societies with high social capital may hesitate to adopt unfamiliar and unconventional new technologies (Ostrom 2000).[61] Hence it can be the case that the same social capital produces opposed results (Akerlof 1976). Stiglitz (2010; 2012), therefore, suggested that learning should be promoted through with government intervention in the market (for detailed discussion regarding this point, please see addendum).[62] As Ostrom (2000) stated, it is important for entrepreneurs to

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[60] As Serageldin and Grootart (2000) discussed, group-based funding is a good example to complement imperfect information in the market, such as Grameen Bank in Bangladesh and tontime (informal saving circles) in West Africa. The group based funding works because it enables members to share closed information which private banks cannot access automatically. They also introduced how Japan and Korea tacked the severe information problem in capital market, establishing deliberation councils (World Bank 1993).

[61] Ostrom (2000: 177) stated that possible negative aspects of norms as follows: 'Thus, investments made in one time period in building trust and reciprocity can produce higher levels of return in future time periods even though the individuals creating trust and reciprocity are not fully conscious of the social capital they construct. Not all norms, however, are based on symmetric relationships. The norm of deference to elders or to those with more status or authority is based fundamentally on a concept of asymmetric relationships. Such norms may be used to generate higher returns in the future, but they may also lead to stagnation and a reluctance to build new types of enterprises. A norm such as retribution-even though it may be based on symmetry-can trigger quite destructive and escalating patterns of conflict and violence and thus be destructive of all forms of capital (underline is added by this author).'

[62] Ostrom (2000: 180) stated that: 'one of the steepest sections of a learning curve-learning to make

understand relevant factors of production and to relate these effectively. Those entrepreneurs try to establish networks of relationships to increase benefits.[63]

With regard to the issue of free riders, Akerlof and Kranton (2000) discussed the idea that group identity affects altruism; hence making group identity stronger is an efficient solution to free riders. This has been confirmed by a number of empirical researches employing the trust game and the dictator game (e.g., Fershtman and Geezy 2001). The sense of community triggers more altruistic behavior which is better aligned with the common good. Moreover, the norms developed in societies alter the actions and preferences of its members. The norm is an expectation placed on others regarding issues and responsibilities (e.g., walking patrols and traffic control in school zones by a Parent–Teacher Association). That is why community and norm building is beneficial in preventing possible external shocks as well as in recovering from shocks.

Social capital not only addresses market failure, but also complements government functions (Durlauf and Fafchamps 2004). Coleman (1988) showed that voluntary participation in a PTA reduces and solves interpersonal conflicts, which cannot be resolved by state intervention. In terms of development, it has been suggested that social capital is especially important in the early stages. Once a sufficient level of general trust is generated, the importance of social capital decreases (North 2001; Durlauf and Fafchamps 2004). That is why even though the social capital of the United States had decreased, as Putnam (2000)

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commitments and to trust one another in a joint undertaking-has already been surmounted. A group that has learned to work effectively together in one task can take on other similar tasks at a cost in time and effort that is far less than that involved in creating an entirely new group out of people who must learn everything from scratch. The fungibility of social capital is, of course, limited. No tool is useful for all tasks. Social capital that is well adapted to one broad set of joint activities may not be easily molded to activities that require vastly different patterns of expectation, authority, and distribution of rewards and costs than used in the initial sets of activities.'

[63] Ostrom (2000: 181) stated that: 'For private sector activities, an important aspect of entrepreneurship is bringing relevant factors of production together and relating them effectively from one to another. Aspects of these skills are taught in schools of management and learned in the workplace through experience. The incentive to create social capital related to private enterprise is attributed to the profit motive. A great deal of what private entrepreneurs do is to create networks of relationships that increase the profits that can be obtained. The private entrepreneur then keeps the residuals from creating and sustaining social capital.'

found, economic performance during the same period was been affected.[64]

Now let us consider the role of social capital in a post-natural disaster context. We will start from the recovery phase. Aldrich (2012) identified three mechanisms that show how social capital works in disaster recovery (see Table 2-2). These are: (1) providing informal insurance for the local community; (2) encouraging collective action to overcome post-disaster problems; and (3) decreasing the probability of residents leaving stricken neighborhoods after a severe disaster.[65]

Table 2-2: The roles of social capital in post-disasters period (during recovery phase)

Broad Mechanism	Post-Disaster Application
Strong social capital provides information, knowledge, and access to members of the network	Social resources serve as informal insurance and mutual assistance after a disaster.
Strong ties create trust among network members	Strong social capital helps by overcoming collective action problems that stymie recovery and rehabilitation
Social capital builds new norms about compliance and participation	Networks strengthen voices and decrease the probability of exit from neighborhood

(Source: Modified by the author based on Aldrich 2012: 46)

During the recovery phase, social capital provides informal insurance in the stricken region. It is known that few households buy market-based insurance (Sawada and Shimizutani 2008), and that it is also difficult for governments to deal with the very first phase of

[64] Durlauf and Fafchamps (2004: 13) stated that: 'Clubs, networks, and community-based voluntary organizations can improve efficiency in economic exchange and public goods delivery. But these are typically second-best solutions. The first-best approach is generally to develop well-functioning legal institutions and state organizations.'

[65] Uphoff (2000) stated that: 'If people are strangers to one another, they are indifferent to each other's well-being. Analytically, this means that they have independent utility functions. They do not care whether others are better off or not and are indifferent whether their own actions help or harm others. This is the standard assumption made in most economic analysis. It was originally made to simplify analysis, but now it is often assumed to be a true description of human nature, consistent with the idea of homo economicus as an individual, self-interested utility maximizer. Friends, by contrast, are persons whose utility functions are positively interdependent, which means that they attach some value to each other's well-being. They consider themselves better off when their friends are wealthier, happier, more secure, or more respected. And finally, enemies are persons whose utility functions are negatively interdependent. Enemies derive satisfaction from their foes' misfortune and even seek to increase this for their own benefit.'

disasters—the recovery phase. Therefore, mutual help within communities after disaster is often critical in the recovery phase. This type of mutual help can include physical help (e.g. the sharing of tools, living space, and food), information sharing, and financial aid, among other things. Information sharing is important to help victims know where help is provided, and it is also important so that government and NGOs (non-governmental organizations) can reach vulnerable people (e.g. the elderly and disabled) in the disaster-affected area. During the chaotic first phase, providing a match between the needy and the help that is on offer is often a very difficult task. Information provided by the informal social network in the area is often most useful in making the emergency resuce operation effective. In addition, for those who are forced to leave because of a disaster, information on how and where other community members have moved affects their decision making about whether to come back or whether to settle down in a new area.

With regard to the second mechanism, collective action, even soon after disasters in the recovery phase, urgently needed information and knowledge to tackle the situation will be shared among community members. In this way, members are able to use scarce resources more efficiently. Stronger social capital encourages more people to participate in community actions. People's collective actions allow them to overcome difficulties which they could not address alone. This is critical in the recovery process. For instance, Nakagawa and Shaw (2004) studied the Mano area of Nagata ward, Kobe, after the Great Hanshin Awaji Earthquake, and the old town of Buji, Gujarat, in India. They found that the work of NGOs was critical in connecting people to recovery work in these regions after disasters. They also reported that the interaction between the official bureaucracy and the local people was best catalyzed by NGOs or voluntary town organizations, and this fostered trust and facilitated a smoother recovery.

The Mano area case studied by Nakagawa and Shaw (2004) relates to the third

mechanism as well, because a social network strengthens the voice from the community and links it to the government bureaucracy. Hence, social capital complements the work of government, as well as the market. This kind of social capital helps people to participate in the community, and to remain in the community or return to it. On the other hand, if people have moved to another place and are isolated from the local network, they would feel more inclined to stay in a completely new area. This happened in Kobe after the earthquake; so many people died in isolation in temporary accommodation in the outer suburbs that a new term was coined to describe the phenomenon: *lonely death*. This happened because victims were randomly allocated to temporary housing by lottery without considering the original local social network they were a part of. It was reported that elderly and disabled people felt isolated at the temporary shelters without any local social network. By contrast, after the Great East Japan Earthquake in 2011, evacuees were allocated to areas based on the communities they had belonged to before the disaster, learning from the mistakes in Kobe.

In the reconstruction phase, the mechanisms by which social capital works are four causal relationships, as Table 2-3 shows. They are: 1) job matching; 2) business information and technology transfer; 3) providing access to distant markets; and 4) transaction cost reduction. Issues in the reconstruction phase are chronic problems that the community faced even before the disaster, but which have been amplified by the disaster. As discussed before, jobs are the key factor for reconstruction. Putnam (2000) emphasized that norms of reciprocity and trustworthiness are the key ingredients of economic growth, and social capital provides such norms to the society.

Table 2-3: The roles of social capital in post-disasters (in the reconstruction phase)

Broad Mechanism	Post-Disaster application
Strong social capital provides information, knowledge, and access to members of the network (decreases asymmetry of information)	Social capital promotes job matching between employer and employee, reducing asymmetry of information.
	Social capital promotes knowledge transfer among networks (e.g., technology and business information) to make industrial clusters more competitive
	Social capital provides access to distant markets.
Strong ties create trust among network members (decreases transaction costs)	Strong social capital reduces transaction costs among neighbors and private sector activities.

(Source: the author)

Asymmetry of information is common in labor markets. In this situation, it is difficult to match actual jobs with the labor available. For the employer, it is not easy to find somebody suitable through terms of reference since it is difficult to get accurate information on job applicants' capacity or human capital. Studying the US labor market, Granovetter (1974) found that social networks raised the efficiency of the job matching process, and sped up the job search for workers. Put more simply, information in the form of personal recommendation addresses the asymmetry of information and catalyzes job matching.

Social capital also decreases transaction costs, as Coase (1937) pointed out. Transaction costs include, as Stiglitz (2000) stated, information costs. If people can trust their business counterparts, then they can avoid certain negotiations and paperwork. If informal financial mechanisms exist, they can provide an important source of investment. For instance, credit unions, *Shinkin*, play a significant role in developing the local economy in Japan, providing necessary investment resources in the spirit of mutual aid. This is a point made by Arrow (1972), who stated that social capital can promote investment, substituting for certain institutions such as a missing or expensive legal framework. Riskier projects can even be resourced with the presence of strong ties or social capital in the society. As repeated games literature has discussed, cooperation becomes easier if there is the prospect of further

interaction in the future (Abreu 1988; Fudenberg and Maskin 1986; Kreps et al. 1982). In the absence of repeated interactions, first-time customers have to be negotiated with to reduce uncertainties. In such cases, projects and activities depend heavily on legal institutions for large contracts and legal matters. Social capital can address market failures by reducing transaction costs in private-sector activities. This promotes new businesses. Further, through social capital, in many cases people do not need contracts, for instance in dealing with neighbors; without social capital, a contract is needed. Putnam (2001) found a correlation between the declining trend in social capital and an increase in the number of lawyers in the United States. Fukuyama (2000: 6) also pointed out that high social capital "reduces the transaction costs associated with the formal coordination mechanism like contracts, hierarchies, bureaucratic rules, and the like."[66]

There are a number of publications on social capital and information sharing among entrepreneurs and within industrial clusters (Nam et al. 2009; Fafchamps and Minten 1999; Granovetter 1974; Montgomery 1991; Rauch and Casella 2001; Greif 1993; Kandori 1992; McMillan and Woodruff 2000; Wade 1987; 1988; Platteau and Seki 2002). For instance, Barr (2000) discussed a social network among entrepreneurs in Ghana that catalyzes information exchange on new technology. The function of social capital in ethnic business enclaves, employing a co-ethnic labor force, has also been extensively studied (Portes 1998). These include Chinatown in New York (Zhou 1992), Little Havana in Miami (Portes 1987; Portes and Stepick 1993; Perez 1992), and Koreatown in Los Angeles (Light and Bonacich 1988; Nee et al. 1994).[67] Stone et al. (1992) studied the garment industries in Brazil and Chile. They found that in Brazil the regulatory system, with inconsistent laws and very expensive

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[66] Aoki (2010) analyzed social capital as the outcome of playing social-exchange games by individual agents. He considered the 'norm' or 'standard of social exchange' as a Nash equilibrium of the psychological game.

[67] Portes (1998) stated that this ethnic niche happen when a group dominate jobs of a particular sector, excluding others to get a new job, and allowing its members to have privilege access. For instance, it is well known that the FDNY (the Fire Department of New York City) is dominated by Italian American.

courts, is too complex. Hence, garment entrepreneurs rely on informal credit information with a premium depending on reputations. Contracts are also insecure in Brazil; these circumstances hinder the expansion of SMEs (small and medium-sized enterprises). The situation is different in Chile, where there is a relatively simple legal system and enforcement. They concluded that, if formal institutions do not work, then social capital works to complement them. Through these mechanisms social capital contributes to reconstruction.

2-5 Research Questions and Structure of Chapters

What about empirical studies? Do they confirm these roles of social capital in post-disaster recovery and reconstruction? Unfortunately, there are only a limited number of empirical studies in this field, and we will intensively review these studies in a later section. Aldrich (2012) conducted a series of empirical studies on the Great Hanshin Awaji Earthquake, Hurricane Katrina in the USA, the 2001 Bhuj earthquake in India, and others. Yamamura (2010) also conducted empirical studies, but his focus was on the preventive side: that is, how social capital has prevented damage from disasters. Hence, there is a strong need to implement empirical studies. In addition, the work of Aldrich mainly focuses on the recovery phase, not reconstruction. As far we are aware, there is no such study dealing with the reconstruction phase. Hence, this thesis aims to contribute to the ongoing discussion on social capital by employing empirical research on the roles of social capital in the post-disaster phase which has not been studied fully. The main

question of this thesis is as follows:

Main Question:

What are the roles of social capital after disasters to enable faster recovery and reconstruction?

To tackle this question, this thesis uses the following resilience framework (fig. 2-9).

This framework uses 'function of society' as the *Y* axis, and divides the post-disaster period into impact, recovery and reconstruction phases. The three sub-questions correspond to these three phases. The sub-questions are as follows:

Sub-question 1 (impacts):

What are the macroeconomic impacts of natural disasters? Do disasters have long-term positive impacts on economic growth?

Sub-question 2 (recovery phase):

Did social capital work in Japan in the recovery process after disasters?

Sub-question 3 (reconstruction phase):

Have both bridging and bonding social capital promoted economic reconstruction after the Great Hanshin Awaji Earthquake?
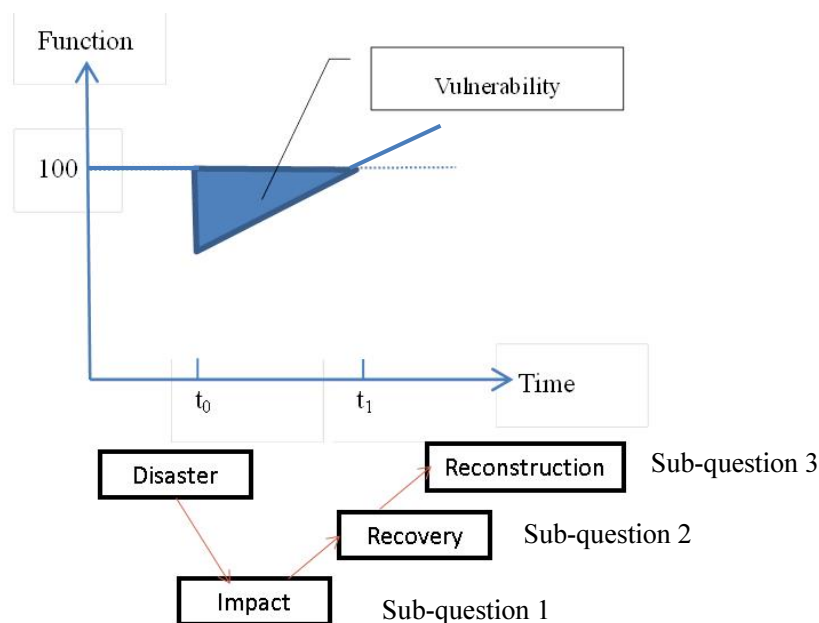
Figure 2-9: Resilience framework
(Source: the author)

The roles of social capital in the post-disaster phase are a new frontier for social capital literature, especially for the reconstruction phase. This thesis also aims to examine 'double-edged sword' aspects: if bonding hampers recovery and reconstruction. Investigating

these questions, this thesis will contribute to the literature on social capital. Further than that, I would like to contribute to the on-going efforts in Tohoku, Japan, highlighting the policy implications from empirical research on how we should utilize social capital to recover and reconstruct.

The rest of the thesis will be organized as follows. Next chapter (Ch.3) will discuss the macroeconomic impacts of natural disasters based on panel data of Japan from 1970 to1998. Then, Ch.4 will discuss the role of social capital in recovery phase based on TSCS (Time-Series-Cross-Section) data from 1970 to 2009. Ch.5 investigates the factor of reconstruction of tertiary industry of Kobe after the Great Hanshin Awaji Earthquake. Policy implications will be drown and concluded in Ch.6.

Table 2-4 summarizes research design of empirical studies. The following each empirical chapter will discuss the details especially on the selection of dependent variable, proxies, and the function form. Just before closing this chapter, we will discuss the selection of proxies to measure social capital.

Table 2-4: Research design of empirical studies

Study	Chapter	Data	Estimation Methods	Dependent Variable	Social Capital Proxies	Function Form
Sub-Q1: Macroeconomic Impacts	Chapter 3	Panel Data of Japanese Prefecture (1970-1998)	Fixed Effects, Ramdom effects, Pooling , PCSE GMM	Growth rate of gross prefectural domestic product	None	log-log
Sub-Q2: Social capital in Recovery Phase	Chapter 4	Panel Data of Japanese Prefecture (1970-2009)	Fixed Effects, Prais-Winsten, PCSE GMM	Population growth rate	Voluntary organizing disaster prevention movement , Number of Community Center	Level-log
Sub-Q3: Bridging and Bonding in Reconstruction Phase	Chapter 5	Panel Data of 9 Wards in Kobe (1995-2010)	Fixed Effects, Prais-Winsten GMM	Employment growth rate	Crime rate, Households with three generation living together	Level-level

(Source: the author)

2-6   *Empirical Studies of Social Capital*

As our review has shown, a definition of social capital is elusive.[68] In line with this, the scholars who contributed to the World Bank's workshop *Social Capital: Integrating the Economist's and the Sociologist's Perspectives*, held in spring 1997, basically agreed that trust relationships are important, and that there was a need for more rigorous empirical research on social capital (Dasgupta and Serageldin 2000).[69] Durlauf and Fafchamps (2004: 2) also proposed more empirical studies to improve and strengthen social capital literature. This is because empirical studies address major issues in various areas of social science; this thesis also aims to contribute to empirical studies.[70]

There has been a growth in the empirical literature on social capital (e.g., La Porta et al. 1997; Glaeser et al. 2002). Empirical studies on social capital have been done in various fields such as socio-epidemiology on poor health and social trust (Kawachi et al. 1999), and in economics with regard to economic growth and trust (e.g., Knack and Keefer

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[68] Some other major definitions are as follows: 'a resource that actors derive from specific social structures and then use to pursue their interests; it is created by changes in the relationship among actors (Baker 1990: 619).' A broader definition by Schiff: 'the set of elements of social structure that affects relations among people and are inputs or arguments of the production and/or utility function (Schiff 1992: 161).' Burt (1992: 9) emphasized weaker ties rather than dense network because dense network just convey general information among members (nothing new) and oppress the flow of information. So he defined social capital as: 'friends, colleagues, and more general contacts through whom you receive opportunities to use your financial and human capital.' Woolcock (1997: 35) note that: 'definitions of social capital should focus primarily on its sources rather than its consequences since long-term benefits, if and when they occur, are the result of a combination of different....types of social relations, combinations whose relative importance will, in all likelihood, shift over time.' The definition by Ostrom (2000: 176) is as follows: 'Social capital is the shared knowledge, understanding, norms, rules, and expectations about patterns of interactions that groups of individuals bring to recurrent activities.' The definition by Uphoff (2000: 216) is as follows: 'Social capital is an accumulation of various types of social, psychological, cultural, cognitive, institutional, and related assets that increase the amount (or probability) of mutually beneficial cooperative behavior.'

[69] Dasgupta and Serageldin (2000: x) stated: '….the reluctance of economists to embrace the term even when engaged in similar research endeavors as those who make use of it may well be because of certain lack of intellectual discipline in some of the more popular writing of social capital. Terminology is not the only issue- neither, in particular, is the fact that social capital refers to something intangible….<u>The problem with social capital is that the concept has not been nailed down sufficiently to be useable in quantitative research into the character of societies.</u> One way to try to pin it down would be to explore the issues that the concept was designed to illuminate, with an attention to both theoretical and empirical detail.' (underline is added by this author)

[70] Recognizing the importance of qualitative research, Durlauf and Fafchamps (2004) pointed out that qualitative studies suffer from 'very distinct conceptual and interpretative questions.'

1997). Regarding economic growth, Knack and Keefer found that an increase in trust increases economic growth. In line with this, Grootaert (1999) and Narayan and Pritchett (1997) found a positive correlation between dense social networks and economic development, comparing a cross-section of villages. Nam et al. (2009) found that social capital promoted industrial clustering in Vietnam. On the other hand, Miguel et al. (2005) studied whether social capital promoted industrialization in Indonesia, and found no evidence that social capital correlated with industrial development across 274 Indonesian districts during the rapid industrialization period from 1985 to 1995. They emphasized that this study looks at country during one period, and may not apply everywhere. In other words, empirical studies have produced contradictory findings, and there is still a need for more empirical studies on the role of social capital.

Putnam (2001) also made an empirical analysis, and found strong correlations between social capital and educational performance, child welfare, murder rates (negative correlation), health, tax evasion, tolerance, economic equality, and civic equality, among others. Figure 2-10 shows one of his results regarding the correlation of social capital and violent crime. Other applications of social capital as a predictor include employment, occupational attainment, and juvenile delinquency, among other things.
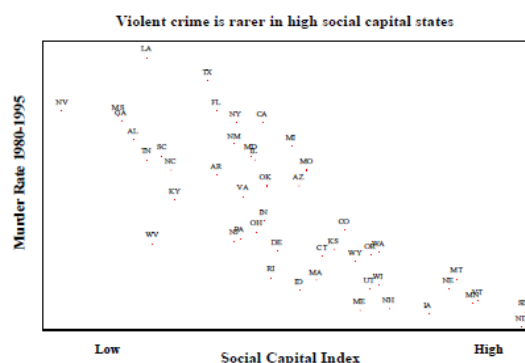
Figure 2-10: Social capital and violent crime
(Source: Putnam 2001: 26)

2-7   Methodology: How to Measure Social Capital and Select Proxies

One of the difficulties with the empirical study proposed above is how to quantify social capital. Because of its nature, as Grootaert and van Bastelaer (2002), and Ostrom (2000) discussed, like human capital, it is difficult to see and measure social capital, so the use of carefully selected proxies is necessary to identify observable variables (Portes 2000).[71] There are several possible ways to capture social capital: 1) by focusing on an attitude and user survey covering a large number of individuals such as the World Value Survey; 2) by focusing on behavior (e.g., whether to lend money or not); and 3) by focusing on participation in activities (e.g., voting and voluntary associations) (Aldrich 2012; Anderson et al. 2004). In previous literature, three methods have been proposed and used to collect data: 1) an index based on an individual questionnaire; 2) a field experiment; and 3) the use of proxies such as the objective statistics of a community.

A questionnaire-based index was developed and proposed by the World Bank (2013b) and Western et al. (2005). The World Bank proposed the Social Capital Assessment Tool (SOCAT) and Social Capital Integrated Questionnaire (SOCAP IQ). The SOCAT comprises questionnaires developed by the Bank to collect data at the household, community, and organizational levels. The SOCAP IQ aims at generating quantitative data on various dimensions.[72] These tools have already been used by various donor agencies.

Western et al. (2005) argued that there are two aspects to social and institutional capital: social structures (networks of social relations) and the norms governing behavior.

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[71] Ostrom (2000: 180) stated as follows: '…. social capital is not as easy to find, see, and measure as is physical capital. The presence of physical capital is usually obvious to external onlookers. Health centers, schools, and roads are simple to see. Social capital, by contrast, may be almost invisible unless serious efforts are made to inquire about the ways in which individuals organize themselves and the rights and duties that guide their behavior sometimes with little conscious thought. Even when asked, local residents may not fully describe the rules they use…. Common understanding is frequently hard to articulate in precise language, particularly when status differentials make communication difficult in the first place.'

[72] The SOCAP IQ covers six dimensions: groups and networks, trust and solidarity, collective action and cooperation, information and communication, social cohesion and inclusion, empowerment and political action.

They further differentiated these two aspects into formal (e.g., work, church) and informal (e.g., family, friends) networks. Thus, they proposed four broad groupings: informal structures, formal structures, informal norms, and formal norms. They use the words "structure" and "norm" in the sense generally implied by "bridges" and "bonds" in social capital literature.[73] Based on the four broad groupings, they developed 14 scales to measure social capital as shown in Table 2-5. This framework was used to design questionnaires to collect data to measure these dimensions of social capital.[74] Both methods have already been applied in various case studies. The Cabinet Office of the Government of Japan (2003; 2005) has also surveyed the situation of social capital at the prefectural level.

Table 2-5: Primary scales and corresponding subscales

Informal Structure	Formal Structure	Informal Norms	Formal Norms
✓ **Community divisions** ✓ **Particularized social agency**	✓ Participation in the local community ✓ Generalized agency ✓ Friends in institutional networks	✓ Particularized trust ✓ Informal reciprocity and exchange	✓ Openness to and tolerance of diversity ✓ Formal reciprocity ✓ Feeling of safety and generalized trust ✓ Community spirit ✓ Place attachment ✓ Confidence in links ✓ Trust of links

(Source: Western et al. 2005)

The second method of measuring social capital involves the use of field experiments such as the dictator game, the trust game, the public goods game, and the

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[73] Uphoff (2000) used the terms 'structural' (e.g., rule, procedure) and 'cognitive' (e.g., norm, value) social capital.

[74] The final questionnaire includes two measures: anomie scale, and perceived quality of life and well-being scale.

ultimatum game (Cardenas and Carpenter 2008). The third method is to use proxies such as the objective statistics of the community drawn from existing data. For instance, Putnam (2000) and Putnam et al. (1993) used public statistics from the United States and Italy. Both questionnaire-based data collection and field experiments are costly, and it takes time to collect data. Compared with the other two methods, the data-based proxy method is less costly since it uses readily available data, and it is easier to construct a time-series dataset to capture the changing trends of society.

However, there are also difficulties. One is the availability of data that can be used for proxies. In many cases, it is difficult to find the data to be used for analysis. Limited availability and problems in finding data are the constraints to this approach. Even if potential data is found for analysis, selecting appropriate proxies is another issue. Social capital proxies need to be selected from the best available data, based on the criteria of culture and history. In many cases, it is difficult to select appropriate proxies to represent the communities. Questions remain about whether the proxies used in a particular study are appropriate to represent the status of social capital. The meaning of certain associations (e.g., labor unions, social clubs, and bowling leagues) in a society changes over time, and new ways to network, such as social networking services (SNS), become more influential. For example, public baths were popular in the past in Japan because it was not common to have a bath in the home, but this is not the case nowadays. Therefore, we need to select the best proxies and the best questionnaire to evaluate social capital in its entirety considering the culture and history of societies.

Hence, there are pros and cons for each method. In a post-disaster situation, however, it is difficult to use questionnaires and field experiments. After the Great East Japan Earthquake, it was reported that too many researchers visited temporary evacuation shelters and handed out questionnaires. Compared with the other two methods, the proxy

approach is more practical. Under budgetary and time constraints, this method is best suited to formulating development policies and plans such as a master plan. In the event of a disaster, the proxy approach can be used to create a recovery and reconstruction plan. This thesis, therefore, employs the existing data-based proxy approach.

What kinds of proxies have been used in the past? Aldrich (2012) employed the number of NPOs (non-profit organizations) created per capita as the proxy (see Table 2-6). Yamamura (2010) used data on the number of community fire-fighting teams, public baths, and community centers as proxies to capture social capital in Japan. Putnam (2001) used several proxies: 1) formal membership and participation in different forms of informal networks (e.g., PTAs); 2) trust (e.g., questions such as 'Do you trust others?'); 3) altruism (doing good for other people, for example volunteer work and giving money/blood); and 4) the number of lawyers (transaction costs between neighbors), among other things. Through examining these proxies with US data, he found a coherent trend among proxies, namely, that there was a transformation trend in social bonds in the US. These are examples of possible proxies. The empirical studies in the following paper will select proxies, carefully using these examples of past literature and the availability of data.

Table 2-6: Social capital proxies

Bonding	Bridging
- **PTA (Putnam 2001; Coleman 1988)** - **Presence of father in home, parents' expectations for school performance (Fursternberg and Hughs 1995)** - **Living arrangements with parents, intensity of interactions with parents (Teachman, Paasch and Carver 1997)** - **Newspaper reading (Putnam 1996)** - **Homogeneity within group in wealth, caste, ethnicity (Varughese and Ostrom 2001)** - **Number of associations in communities (Carter and Maluccio 2003)** - **Number of lawyers (Putnam 2001)** - **Homogeneity of companies of soldiers with respect to ethnicity, occupation and age (Costa and Kahn 2003)** - **World value survey (Knack and Keefer 1997)** - **Number of public baths (Yamamura 2010)**	- Voting rate (Aldrich 2012; Guiso, Sepienza and Zingales 2002) - Crime rate (Putnam 2001) - Number of lawyers (Putnam 2001) - Neighborhood quality, help network (Furstenberg and Hughes 1995) - Volunteer hours (Putnam 2001) - Number of NGOs (Aldrich 2012) - Use of employees social networks in making new hires (Fernandez, Castilla, and Moore 2000) - World value survey (Knack and Keefer 1997)

(Source: the author)

2-8 Conclusion

The damage caused by natural disasters is irreversible. Infrastructure can be returned to its original shape, but society and the lives of people never return to the same state as before. Lost lives never come back. There is absolute loss. In essence, all the activities in post-disaster phase are directed toward creating a new society. Hence, to promote resilience, we need first of all to restore social function to normal as soon as possible, and then, beyond the recovery phase, it is necessary to have a mid- to long-term perspective for recreating new societies and lives.

To make societies resilient, social capital plays the central role complementing with formal institution and market. The Rest of the thesis aims to empirically examine the roles of social capital in recovery and reconstruction phase.

Chapter 3 – The macroeconomic impacts of natural disasters: A case study of Japan

1. Introduction

On March 11, 2011, the Great East Japan Earthquake, the fourth largest in recorded history, caused a major tsunami on a scale that occurs only once every few hundred years which claimed around 20,000 lives. After the earthquake, there was widespread debate over the long-term economic impact of natural disasters. For instance, Sawada et al. (2011) argued that disasters cause positive economic growth through the "Schumpeterian" creative destruction process. However, even seventeen years after the Great Hanshin Awaji Earthquake (or Kobe earthquake) in 1995, it is still difficult to say that the economy of the region has fully recovered. Do disasters really have a long-term positive impact on economic growth?

Economic analysis on natural disasters has only just started. Only a small number of papers have done empirical analysis in the past, but the number has been growing over the last few years. There is no consensus as to whether natural disasters have a positive or negative impact. There is a strong need for more empirical studies.

As we will see in detail in the next section, previous literature has failed to capture the heterogeneous characteristics of natural disasters. Most studies use the number of disasters occurring across countries as an explanatory variable. Considering the nature of most disasters, their direct impact is local rather than national. Hence, for empirical study, it seems more appropriate to use disaggregated data to capture the heterogeneous nature of disasters. For example, in the case of Japan, prefectural data on disasters is available. Utilizing these data, we would be able to capture a better picture of the macroeconomic

impact.

Furthermore, most studies analyze the correlation between economic growth and the number of natural disasters. Since natural disasters have different effects depending on various conditions (e.g. the impact of earthquakes is different depending on their magnitude), it seems more appropriate to use data such as the total amount of damage and the number of victims, rather than the number of disasters, to capture the real impact.

To tackle these issues, this thesis investigates the impact of natural disasters on the growth rate of gross prefectural domestic product, utilizing the 47 prefectural governments' unbalanced panel data for Japan for twenty years from 1975 to 1995.

2. The macro-economic impact of natural disasters in previous research

There are three types of research. The first type investigates the macroeconomic impact of natural disasters (e.g. Albala-Bertrand 1993a; 1993b; Skidmore and Toya 2002; Khan 2005; Noy 2009; Noy and Vu 2010; Sawada et al. 2011). The second is microeconomic research, especially disaster impacts on household consumption and the role of insurance in supporting household recovery (Barro 2009; Sawada and Shimizutani 2008). The third type examines specific disasters, such as the Kobe earthquake or Hurricane Mitch in Honduras, paying particular attention on specific aspects such as the role of social capital (e.g. Horwich 2000; Benson and Clay 2004; Aldrich 2010).

This thesis focuses on the first category. There is an ongoing debate, as we will see, on whether disasters have positive or negative macroeconomic impacts. Some analysts have found that natural disasters are detrimental to economic growth, but others have found them to be a form of "Schumpeterian creative destruction." There is a need for more empirical study, and this thesis aims to contribute to this debate.

Disasters can be classified into three categories according to the Center for

Research on Epidemiology of Disasters (CRED): natural disasters, technological disasters (e.g. industrial accidents), and man-made disasters (e.g. war, financial crises) (CRED 2010). Depending on the study, the definition of disaster is different. This thesis focuses only on natural disasters. Macroeconomic impacts can be different depending on the time frame (short term or long term). This section reviews existing studies that classify these two frameworks. Many past studies have used cross-country panel data, which is available from EM-DAT. There are very few papers that examine the impact on a specific country (e.g. Noy and Vu 2010, on Vietnam). This thesis is one of them.

2.1. Short-term impact of disasters

The study of the economic impacts of disasters started with the short-term effects on the economy. The growth model approach to natural disasters was first introduced by Dacy and Kunreuther (1969). They found that Gross Domestic Product (GDP) tends to increase immediately after a natural disaster. This analysis is supported by empirical studies by Albala-Bertrand (1993a; 1993b) and Tol and Leek (1999). The former developed an analytical model of disasters and response and collected data on disasters (28 disasters in 26 countries during 1969–79). Using before–after statistical analysis, he found that the following variables increase: GDP, capital formation, twin deficits, and agricultural and construction output. He concluded that capital loss is unlikely to have a profound effect on growth and that a very moderate response expenditure may be sufficient to prevent the growth rate of output from falling.[75] Tol and Leek (1999) found a positive impact on GDP in the short term following a natural disaster, explaining that the disaster destroys the capital stock and increases the flow of new production.

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[75] He found no long-run effects in developing countries. His finding was that in developing countries aggregate negative effects lasted only two years. Hence, he concluded that natural disaster effects are primarily a "problem of development," but essentially not a "problem for development."

Chaveriat (2000) and Hochrainer (2009), however, found a mixed picture. Chaveriat found a pattern of GDP decreasing in the year of the disaster, followed by growth in the following two years. The growth results from the high investment in fixed capital. The paper also argued that the short-term negative impact depended on the scale of the disasters (e.g. the loss-to-GDP ratio). Hochrainer studied the counterfactual versus the observed GDP. He also examined the disaster impact of factors such as vulnerability, hazard, and exposure of assets. He found that in the medium term (up to five years) natural disasters often lead to negative consequences. As these empirical studies show, views on the short- and middle-term impacts vary.

2.2. Long-term economic growth

Natural disasters can have long-term effects through various causal relations. Those causal relations include destruction of schools; the crowding out effect of reconstruction expenditure on private investment; worsening fiscal balance leading to inflation; and environmental damage to agriculture, fishing, and forestry (Rasmussen 2004).

When we discuss long-term economic growth, as Hallegatte and Przyluski (2010) pointed out, it is important to distinguish between direct and indirect losses. The former is damage caused immediately by the disaster, and the latter is damage "that [is] not provoked by the disaster itself, but by its consequences such as reduction in economic output" (Sawada et al. 2011: 4). Sawada et al. insisted that direct losses alone are not a sufficient indicator of a disaster's seriousness and that it is crucial to include indirect losses. However, there are large uncertainties in estimating indirect disaster cost, and it is impossible to define "the cost" of a disaster as the relevant cost depends largely on the purpose of assessment.

Regarding the indirect cost of natural disasters, Skidmore and Toya (2002)

extended the short-term analysis to long-term economic impact by examining the causal linkage among disasters, decision making on investment, and total factor of productivity (TFP). They also examined the long-term effects of natural disasters on growth, examining whether natural disasters lead to a higher economic growth rate by promoting the introduction of new technologies and investment in human capital (endogenous growth framework). They counted the frequency of natural disasters from 1960–1990 across countries and pursued an empirical investigation.[76] Their regression found that climatic disasters have positive and statistically significant impacts on the growth of TFP. On the other hand, geological disasters are generally statistically insignificant.

The findings of Sawada et al. (2011) are in line with Skidmore and Toya (2002), that is, that disasters have positive effects on economic growth, especially climatic disasters. They quantitatively assessed and compared various natural and man-made disaster impacts using 189 cross-country panel data between 1968 and 2001. The empirical findings were as follows. First, in the short term all disasters had negative impacts on GDP per capita. This is particularly true of climatological disasters, conflicts and financial crises. Second, in the long term natural disasters had very strong positive impacts on the growth of GDP per capita. Sawada et al. argued that this counterintuitive positive growth effect was a result of the "Schumpeterian" creative destruction process.

Regarding their findings on long-term impacts, it would be best to read the results carefully. Even if the total estimate of natural disaster impacts in the long term is positive, different disasters have different impacts. While climatological disasters have a positive impact after twenty years, geophysical disasters have a negative impact over any time

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[76] They have three hypotheses. First, they stated that disaster risks could have both positive and negative ambiguous impacts. They argued that the impact could be negative by lowering the expectation on the rate of return on physical capital, but would also lead to increased investment to meet the needs of disaster management. Second, regarding human capital, they followed the endogenous growth theory (Lucas 1988; Azariadis and Drazen 1990). They argued that a low expected rate of return on physical capital could shift to a human capital increase, then to a higher rate of economic growth.

framework. This difference needs to be taken into consideration when making long-term recovery plans after a disaster such as the Great East Japan Earthquake.

Contrary to the findings of Skidmore and Toya and Sawada et al., the results of the research by Cuaresma et al. (2008) showed a different picture. They argued that the view expressed by Skidmore and Toya on "Schumpeterian" creative destruction is different from that of Schumpeter himself (1950). Schumpeter's view on creative destruction stressed the importance of "competition" in a perfectly functioning market as an engine for technological progress, but Skidmore and Toya use the same term as more literal interpretation only for technological replacement after a disaster. The paper tested the validity of the Schumpeterian view expressed by Skidmore and Toya by means of a gravity equation to examine the correlation between transfer of technology and disasters in developing countries in the long term. Cuaresma et al. found that disasters are negatively correlated to the adoption of new technology from abroad, and only countries with a higher level of development benefit from the introduction of technology after disasters.

Similarly, Noy (2009) found that 1) the amount of property damage caused by disasters is a negative determinant of GDP growth and 2) there is no correlation between the number of victims (killed or affected) and growth of GDP. He studied the determinants of macroeconomic output decline, using a linear regression model approach, and found that countries with the following factors are resilient to initial disaster shocks and further worsening of the macroeconomy. The factors he discussed are 1) higher rate of literacy, 2) better institutions, 3) better per capita income, 4) higher degree of openness to trade, and 5) higher levels of government spending.

The other empirical study that argues that natural disasters have negative impacts on economic growth in the long term is Benson and Clay (2003), while World Bank (2003) and Rasmussen (2004) found that natural disasters have no significant impact on economic

growth. Rasmussen (2004) studied several Caribbean islands. He found that developing countries tend to be affected the most by natural disasters. Small island states have a high frequency of natural disasters. The paper identified a median reduction of the growth rate of 2.2 percentage points in the year of the event, but found that the long-term effect of natural disasters was indeterminate.[77]

From this review of previous literature, we see that there is no consensus as to the macroeconomic impact of disasters. There is a strong need for more empirical studies on the consequences. Accumulating this knowledge will certainly contribute to policy planning for recovery after a disaster.

One of the common problems with previous literature is the treatment of data. Almost all of the previous literature uses the EM-DAT database constructed and maintained by the Centre for Research on the Epidemiology of Disasters (CRED).[78] The EM-DAT database is global, and contains natural disaster data from 1900 to the present. It seems, however, that past literature has failed to capture the heterogeneous characteristics of natural disasters. Most studies use the number of disasters in a country as an explanatory variable. Considering the nature of a disaster, its direct impact is local rather than national. For example, Okinawa is far to the south of the Japanese mainland and is prone to have more hurricanes than Tokyo. The case is similar for Hawaii and the USA. Hence, for empirical study, it seems to be more appropriate to use disaggregated data to capture the heterogeneous nature of disasters. For example, in the case of Japan, prefectural data on disasters is available. Utilizing these data, we are able to capture a better picture of the impact.

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[77] Rasmussen (2004) provides a box reviewing studies on the macroeconomic implications of natural disasters such as 1) an immediate decrease in economic output; 2) a worsening of external balance; 3) deterioration in fiscal balances; and 4) poverty increase.

[78] According to the CRED homepage, the database is compiled from various sources such as UN agencies, NGOs, insurance companies, research institutions, and press agencies.

Furthermore, most studies like that of Skidmore and Toya (2002) analyze the correlation between the "number" of natural disasters and economic growth. Again, natural disasters have different effects depending on various conditions (e.g. an earthquake's magnitude). Therefore, rather than the number of disasters, it seems more appropriate to use data such as the total amount of damage and the number of victims to capture the real impact, because the number of people affected indicates the direct impact of the disaster.[79]

3. Initial evidence on disasters and economic growth

Before going into detail, this thesis will present on initial analysis on the simple correlation between disasters and long-term economic growth for the 47 prefectures of Japan using the same analytical framework of Skidmore and Toya (2002) (fig. 3-1). The vertical axis shows the average annual per capita growth rate over the 1970–98 period. The horizontal axis measures the likelihood of a natural disaster. Skidmore and Toya (2002) presented the relationship between the total number of disasters and per capita GDP growth. As discussed above, instead of the number of disasters, in this thesis the natural log of the number of victims was used as a better indicator to grasp the impact of natural disasters.[80]

This regression line shows a statistically significant negative correlation between the number of victims and economic growth. The coefficient is -0.069. This seems to be very small, but the absolute value of the coefficient is still greater than that of Skidmore and Toya (2002), which is 0.0033. On the basis of this number they argued that disasters have a positive impact. Naturally, the impact of a natural disaster on economic growth is small, but this estimate is statistically robust, and explains as much as 8.99 percent of the

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[79] Noy (2009) disaggregated the EM-DAT data by region. He found that island countries are on average twice as vulnerable to disasters as other countries.

[80] This thesis uses absolute figures rather than relative figures. The previous literature uses both. This is because absolute figures sometimes better capture the real impact of a natural disaster. Furthermore, past studies, such as Skidmore and Toya (2002), examined the impact using both relative and absolute figures, and found the same results each time.

variation in the growth of per capita GDP.
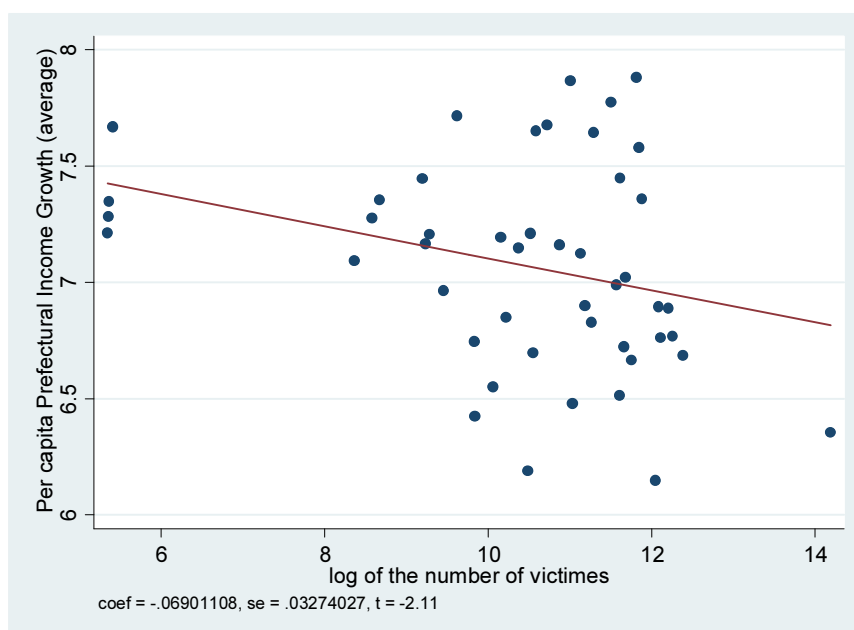
Figure 3-1: Per capita prefectural income growth and disaster

(Source: the author)

Table 3-1: Per capita prefectural income growth and disaster

Dependent variable: Per capita prefectural income growth (average)

log victims	-0.069
	[-2.11]**
Constant	7.7936
	[22.49]***
N	47
R-squared	0.0899
Adj-R-squared	0.0696
* p<0.1, ** p<0.05, *** p<0.01	

(Source: the author)

Table 3-2: Definitions and sources of variables

Variables	Description	Source
gdp_pc_ave	Per capita prefectural income growth	Cabinet Office, Government of Japan
log victims	Logarithm of the number of victims	Prefectural data on natural disaster, Statics Bureau, Ministry of Internal Affairs and Communications

(Source: the author)

Table 3-3: Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Gdp_pc_ave	47	7.075348	0.44705	6.148276	7.882759
victims	47	100442.8	211094.6	209.2	1448103

(Source: the author)

4. Data

For more detailed empirical analysis, this thesis used the variables listed in Table 3-4. The definitions and data sources are also listed in Table 3-5. As discussed in the literature review section, this thesis uses prefectural disaster data. The database is unbalanced panel data, covering all 47 Japanese prefectures for twenty years from 1975–1995. The maximum amount of total damage is huge because of the Great Hanshin Awaji Earthquake in 1995.

On the other hand, there is no prefectural data available on the number of disasters to actually hit a prefecture classified into geophysical disasters, meteorological disasters, and hydrological disasters. Therefore, unlike other past studies, this thesis will not compare the impacts of each class of disaster. Furthermore, past studies differentiated between rich and poor countries, but in the case of Japan the gap among prefectures is small, and in many cases people easily move from one prefecture to another. Therefore, this thesis will not classify prefectures into income groups.

Table 3-4: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
GPDP	1128	7,560,000,000,000	10,900,000,000,000	667,000,000,000	86,100,000,000,000
pgex	1360	656,000,000	761,000,000	46,600,000	7,030,000,000
pgexrcv	1360	8365957	8,859,131	19,000	124,000,000
Tot_damage	1340	373,000,000,000	4,220,000,000,000	1,000,000	137,000,000,000,000

(Source: the author)

Table 3-5: Definitions and sources of variables

Variable	Description	Source
GPDP_r	Growth of gross prefectural domestic product (at current price)	Cabinet Office, Government of Japan
Pgex_r	Growth of prefectural government expenditure	Ministry of Internal Affairs and Communication (Chihou Zaisei Nenpou)
Privtcapstx_r	Growth of prefectural private capital stock	Takero Doi (2002)
Tot_damage	Total amount of prefectural damage in Japanese Yen	White paper by the Fire Defense Agency (each year)

(Source: the author)

5. Methodology

In order to set the stage for the analysis, this section presents an analytical framework for empirical analysis, which modifies the model of Noy (2009) and Noy and Vu (2010).

$$\log \Delta Y_{i,t} = \alpha_i + \beta \log \Delta Y_{i,t-1} + \gamma \log Dis_{i,t-1} + \mu \Delta \log X_{i,t,.} + \varepsilon_{i,t}$$

$\Delta Y_{i,t}$ is the annual GDI (Gross Domestic Income) growth rate. i is a prefectural index to capture prefecture-specific effects, and t is the time index. $Dis_{i,t-1}$ is the measure for disaster magnitude, estimated by the amount of direct damage. Since disaster affects the following year, this is the disaster lag variable. $\Delta X_{i,.}^1$ is control lagged variables (such as growth of prefectural government expenditure and growth of prefectural private capital

stock). This model includes a GDI growth lag following Islam (1995).

Islam (1995) also stated that a time span of just one year is too short because the short-term business cycle may influence the estimation results over such brief spans, so he proposed five-year time intervals. This is because his study focused on convergence. Unlike literature on convergence, the impact of external shocks such as disasters differs year by year, especially during the first several years. Hence, instead of five-year time intervals, this thesis employs annual data.

The lagged dependent variable might correlate with the error term. If this is the case, the conventional panel data analysis methods (pooling cross-sections across time, fixed effects, and random effects) are not consistent. These estimators are consistent only when all regressors are not correlated to the error term. In order to correct for the bias arising from the presence of a lagged dependent variable, this thesis also employs the Prais-Winsten estimation, PCSE (panel-corrected standard error), and the system General Method of Moments (GMM) estimator (Noy and Vu 2010; Roodman 2003).

The Prais-Winsten estimation is a method of multiple linear regression with AR(1) and exogenous explanatory variables. The Prais-Winsten standard errors account for serial correlation; the OLS standard errors do not.

The PCSE (panel-corrected standard error) handles the issue of cross-section heteroskedasticity (Beck and Katz 2004). The presence of heteroskedasticity makes the OLS standard errors inconsistent. PCSE improves on OLS standard errors with respect to panel heteroskedasticity, but not other issues.

The system GMM is used to tackle other possible biases by endogeneity and omitted variables in addition to the bias. Arellano and Bond (1991) first established the "difference-GMM" estimator for dynamic panels (Roodman 2003). Arellano and Bond's estimation starts by transforming all regressors, by differencing, and uses the GMM. The

method regards lagged dependent variables as not exogenous and predetermined. A problem with the original Arellano–Bond difference-GMM estimator is that if there is an issue of a random walk of endogenous variables, the estimation becomes biased coefficient estimation.

To tackle the above problem, Blundell and Bond (1998) articulated an improvement on augmented difference GMM by Arrelano and Bover (1995), adding more assumptions that the first difference of instrument variables are uncorrelated with the fixed effects, allowing more instruments to be introduced and making them exogenous to the fixed effects. The augmented estimator is called "system GMM." The command xtabond2 implements both estimations by Stata. The major advantage of the system GMM estimation, compared with the difference GMM, is that this approach effectively controls for autocorrelation and heteroskedasticity.

The system GMM estimation corrects for omitted variable bias by eliminating fixed effects through first-differencing, and for endogeneity bias using lagged endogenous regressors as effective instruments. In our system of GMM estimation, the lagged dependent variable is considered to be endogenous. This thesis employs one-step estimation and implements the Hansen test to verify whether the instruments really satisfy the orthogonality condition (uncorrelated with the error term), and also implements the AR(1) and AR(2) test for autocorrelation.

6.   Estimation results: the impacts on economic growth

The results are presented in Tables 3-6, 3-7, 3-8, 3-9, 3-10, 3-11 and 3-12. Each table shows the results from a different time lag of *tot_damage*, starting from 1 year to 20 years. As Table 3-6 shows, the F-test result (Prob>F=0.6189) indicates that the pooling model is more appropriate than the fixed effects estimation. Considering this, the Breusch and

Pagan test and the Hausman test were implemented. The Breusch and Pagan test result (Prob > chibar2 =1.0000) indicates that the pooling regression model is more appropriate than the random-effects model. The Hausman test result (Prob>chi2 = 0.0000) means the fixed effects model is better than the random effects model. These three tests confirm that the pooling is the most suitable.

According to pooling, random effect, and fixed effect estimates, the results became significantly negative in years 3, 5, 6, 9, 10, 11 and 15. In these years, all three estimations returned the same results. In addition, fixed effect estimation returned statistically negative results in years 12 and 14. In sum, the conventional panel data analyses show negative impacts of natural disasters not just in the short term but in the long term as well.

The results of the Prais-Winsten estimation agreed, finding statistically negative results in years 1, 3, 4, 5, 6, 7. 8. 9, 10, and 11.[81] The negative impacts of natural disasters further were confirmed by the PCSE estimation. All estimated results became significantly negative. Due to the unbalanced nature of the panel, results were estimated until the 16-year lag.

The results of the system GMM confirmed the impacts. The results of the Hansen test, AR(1) and AR(2) imply that, in most cases, the instruments are orthogonal to the error term and the error term is not autocorrelated in the system GMM estimation. The system GMM results became negative and consistent all through the years.

Conclusion

This thesis analyzed the economic impact of natural disasters by utilizing the 47 prefectural panel data of Japan for twenty years. What can we conclude from the empirical findings above? The initial empirical study of "average annual per capita growth rate over

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[81] The Prais-Winsten estimation did not estimate in year 16 because convergence was not achieved.

the 1970–98 period" and "natural log of the number of victims" showed a negative and statistically significant relationship. In the following detailed study, this thesis employed the conventional panel data analyses (pooling, fixed effects, and random effects), Prais-Winsten and PCSE and the system GMM. Unlike several previous studies, which found positive long-term effects of natural disasters, this thesis found that the impacts are robustly negative according to our analyses.

This study indicates that the impacts from natural disasters are long-lasting. Hence, it is necessary to consider short-term recovery policy as well as mid- and long-term reconstruction policy. We will investigate the roles of social capital in recovery phase in the next paper, then the following paper will discuss the reconstruction phase.

The findings of this thesis are specific to Japan. In the future, more analysis of this kind will be necessary from other regions and countries especially in developing countries where natural disasters hit harder than in developed countries.

Table 3-6: Estimation result 1

Dependent Variable : Growth of gross prefectural domestic product	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one step
Log (Growth of gross prefectural domestic product) (Lagged)	0.2466 [6.77]***	0.2466 [6.77]***	0.1883 [4.93]***	0.4321 [12.49]***	0.2606 [3.74]***	0.1632 [2.69]***	0.2548 [7.06]***	0.2548 [7.06]***	0.1983 [5.25]***	0.424 [12.23]***	0.2716 [5.48]***	0.2219 [4.15]***	0.2398 [6.68]***	0.2398 [6.68]***	0.1814 [4.83]***	0.3747 [10.75]***	0.2443 [6.75]***	0.1955 [3.36]***
Log (growth of prefectural government expenditure)	0.1526 [4.91]***	0.1526 [4.91]***	0.1468 [4.61]***	0.1335 [4.48]***	0.1476 [2.82]***	0.1062 [3.45]***	0.1513 [4.86]***	0.1513 [4.86]***	0.1468 [4.62]***	0.1347 [4.49]***	0.1415 [3.23]***	0.096 [3.06]***	0.1381 [4.47]***	0.1381 [4.47]***	0.1353 [4.27]***	0.1262 [4.17]***	0.1354 [3.65]***	0.0985 [3.27]***
Log (growth of prefectural private capital stock)	1.0098 [7.84]***	1.0098 [7.84]***	1.3818 [8.91]***	0.7074 [6.30]***	0.7171 [5.42]***	0.864 [8.80]***	1.03 [7.96]***	1.03 [7.96]***	1.4237 [9.11]***	0.7523 [6.59]***	0.6751 [6.82]***	0.7218 [8.50]***	0.9455 [7.39]***	0.9455 [7.39]***	1.2829 [8.29]***	0.7572 [6.52]***	0.8445 [10.52]***	0.498 [11.36]***
Log (Total amount of prefectural damage) (lagged 1 year)	-0.0212 [-1.63]	-0.0212 [-1.63]	-0.0108 [-0.63]	-0.0287 [-2.44]**	-0.0429 [-2.18]**	-0.047 [-4.09]***												
Log (Total amount of prefectural damage) (lagged 2 years)							-0.006 [-0.43]	-0.006 [-0.43]	0.021 [1.13]	-0.013 [-1.04]	-0.0357 [-2.41]**	-0.0277 [-2.86]***						
Log (Total amount of prefectural damage) (lagged 3 years)													-0.0556 [-4.22]***	-0.0556 [-4.22]***	-0.0691 [-4.04]***	-0.0456 [-3.68]***	-0.0636 [-5.08]***	-0.0696 [-6.21]***
_cons	-0.7075 [-2.72]***	-0.7075 [-2.72]***	-1.3576 [-4.33]***	-0.3743 [-1.63]			-0.8927 [-3.30]***	-0.8927 [-3.30]***	-1.7341 [-5.20]***	-0.5817 [-2.41]**			-0.2509 [-0.95]	-0.2509 [-0.95]	-0.6299 [-1.96]*	-0.2063 [-0.85]		
N	837	837	837	837	837	837	839	839	839	839	839	839	838	838	838	838	838	838
R-squared	0.2795		0.2767	0.4154	0.823		0.2813		0.2819	0.4043	0.8223		0.295		0.2946	0.3829	0.8279	
Adj-R-squared	0.276		0.2307	0.4126			0.2779		0.2363	0.4014			0.2916		0.2497	0.3800		
AR (1)						0.002						0.002						0.002
AR (2)						0.426						0.377						0.392
Hansen Test						0.215						0.215						0.207
Breusch and Pagan Lagrangian multiplier test	Prob > chibar2 = 1.0000																	
F-Test	Prob > F = 0.6189																	
Hausman Test	Prob>chi2 = 0.0000																	
* p<0.1, ** p<0.05, *** p<0.01																		

(Source: the author)

Table 3-7: Estimation result 2

Dependent Variable : Growth of gross prefectural domestic product

	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one
Log (Growth of gross prefectural domestic product)	0.242	0.242	0.1821	0.417	0.2512	0.2218	0.2265	0.2265	0.159	0.3652	0.2271	0.1252	0.2354	0.2354	0.172	0.4045	0.2428	0.1486
	[6.51]***	[6.51]***	[4.64]***	[11.76]***	[5.85]***	[3.96]***	[6.32]***	[6.32]***	[4.26]***	[10.49]***	[5.45]***	[2.07]**	[6.40]***	[6.40]***	[4.44]***	[11.48]***	[9.76]***	[2.41]**
Log (growth of prefectural government expenditure)	0.1439	0.1439	0.1386	0.1265	0.1273	0.0870	0.1331	0.1331	0.1206	0.1218	0.1328	0.0926	0.1478	0.1478	0.1402	0.1321	0.1435	0.1039
	[4.50]***	[4.50]***	[4.22]***	[4.12]***	[3.73]***	[2.73]***	[4.33]***	[4.33]***	[3.86]***	[4.06]***	[4.70]***	[3.12]***	[4.74]***	[4.74]***	[4.39]***	[4.39]***	[6.96]***	[3.24]***
Log (growth of prefectural private capital stock)	1.0463	1.0463	1.4139	0.7743	0.7229	0.7172	0.9914	0.9914	1.4202	0.783	0.9787	1.1605	1.0308	1.0308	1.4136	0.7761	0.7957	0.9332
	[8.18]***	[8.18]***	[9.14]***	[6.88]***	[9.12]***	[7.45]***	[7.88]***	[7.88]***	[9.46]***	[6.87]***	[10.70]***	[8.30]***	[8.04]***	[8.04]***	[9.17]***	[6.83]***	[11.00]***	[8.59]***
Log (Total amount of prefectural damage) (lagged 4)	-0.0126	-0.0126	-0.0059	-0.0143	-0.0393	-0.0255												
	[-0.92]	[-0.92]	[-0.34]	[-1.13]	[-3.19]***	[-1.99]**												
Log (Total amount of prefectural damage) (lagged 5)							-0.0881	-0.0881	-0.1371	-0.0769	-0.0893	-0.1004						
							[-5.72]***	[-5.72]***	[-6.55]***	[-5.39]***	[-6.07]***	[-4.64]***						
Log (Total amount of prefectural damage) (lagged 6)													-0.0328	-0.0328	-0.039	-0.0286	-0.057	-0.0605
													[-2.04]**	[-2.04]**	[-1.72]*	[-1.96]***	[-4.71]***	[-4.20]***
_cons	-0.832	-0.832	-1.4396	-0.5903			-0.0335	-0.0335	-0.2372	0.0317			-0.6286	-0.6286	-1.1402	-0.4622		
	[-3.20]***	[-3.20]***	[-4.75]***	[-2.55]**			[-0.13]	[-0.13]	[-0.77]	[0.13]			[-2.33]**	[-2.33]**	[-3.50]***	[-1.92]*		
N	835	835	835	835	835	835	835	835	835	835	835	835	834	834	834	834	834	834
R-squared	0.2757		0.274	0.3994	0.8212		0.3021		0.3105	0.3895	0.83		0.2781		0.2762	0.3921	0.8226	
Adj-R-squared	0.2722		0.2277	0.3965			0.2987		0.2665	0.3865			0.2746		0.2299	0.3891		
AR (1)						0.001						0.000						0.001
AR (2)						0.325						0.442						0.347
Hansen Test						0.218						0.215						0.210

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

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Table 3-8: Estimation result 3

	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one
Log (Growth of gross prefectural domestic product)	0.2476	0.2476	0.1855	0.4095	0.2667	0.207	0.2225	0.2225	0.1521	0.3584	0.2412	0.182	0.2017	0.2017	0.1235	0.3361	0.2201	0.163
	[6.84]***	[6.84]***	[4.89]***	[11.78]***	[9.28]***	[3.60]***	[5.90]***	[5.90]***	[3.81]***	[9.78]***	[7.50]***	[3.19]***	[5.19]***	[5.19]***	[3.00]***	[8.90]***	[12.14]***	[2.68]***
Log (growth of prefectural government expenditure)	0.1434	0.1434	0.1351	0.1291	0.1347	0.093	0.1219	0.1219	0.1122	0.1129	0.1156	0.080	0.0907	0.0907	0.0795	0.0863	0.0868	0.053
	[4.57]***	[4.57]***	[4.19]***	[4.25]***	[4.92]***	[2.87]***	[3.72]***	[3.72]***	[3.34]***	[3.51]***	[4.28]***	[2.54]**	[2.65]***	[2.65]***	[2.26]**	[2.56]**	[7.27]***	[1.61]
Log (growth of prefectural private capital stock)	1.0424	1.0424	1.4235	0.7913	0.7279	0.814	1.1089	1.1089	1.5229	0.8917	0.7794	0.862	1.1628	1.1628	1.6343	0.9466	0.8709	0.924
	[8.11]***	[8.11]***	[9.22]***	[6.93]***	[15.24]***	[9.04]***	[8.21]***	[8.21]***	[9.28]***	[7.24]***	[10.19]***	[9.18]***	[8.24]***	[8.24]***	[9.51]***	[7.31]***	[8.83]***	[8.95]***
Log (Total amount of prefectural damage) (lagged 7	-0.0173	-0.0173	-0.0184	-0.0158	-0.047	-0.046												
	[-1.10]	[-1.10]	[-0.82]	[-1.11]	[-4.96]***	[-3.63]***												
Log (Total amount of prefectural damage) (lagged 8							-0.02	-0.02	-0.0155	-0.02	-0.0515	-0.052						
							[-1.20]	[-1.20]	[-0.66]	[-1.30]	[-3.79]***	[-4.09]***						
Log (Total amount of prefectural damage) (lagged 9													-0.0376	-0.0376	-0.055	-0.0383	-0.0643	-0.059
													[-2.20]**	[-2.20]**	[-2.28]**	[-2.41]**	[-3.68]***	[-3.91]***
_cons	-0.8039	-0.8039	-1.3574	-0.6078			-0.8421	-0.8421	-1.4883	-0.6555			-0.7294	-0.7294	-1.2767	-0.5376		
	[-3.04]***	[-3.04]***	[-4.29]***	[-2.57]**			[-3.06]***	[-3.06]***	[-4.60]***	[-2.60]***			[-2.57]**	[-2.57]**	[-3.86]***	[-2.05]**		
N	832	832	832	832	832	832	785	785	785	785	785	785	739	739	739	739	739	739
R-squared	0.2781		0.2793	0.3921	0.8202		0.2544		0.2542	0.3408	0.8054		0.2393		0.2395	0.3236	0.7925	
Adj-R-squared	0.2746		0.2331	0.3892			0.2506		0.2034	0.3374			0.2351		0.1843	0.32		
AR (1)						0.001						0.002						0.001
AR (2)						0.335						0.316						0.309
Hansen Test						0.208						0.201						0.220

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

Table 3-9: Estimation result 4

Dependent Variable: Growth of gross prefectural domestic product

	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one
Log (Growth of gross prefectural domestic product)	0.1762 [4.37]***	0.1762 [4.37]***	0.0974 [2.30]**	0.2629 [6.61]***	0.1958 [4.82]***	0.129 [2.10]**	0.1468 [3.52]***	0.1468 [3.52]***	0.0603 [1.36]	0.1152 [2.75]***	0.1601 [2.60]***	0.095 [1.46]	0.149 [3.34]***	0.149 [3.34]***	0.0471 [1.00]	-0.0677 [-1.52]	0.1657 [6.54]***	0.073 [1.06]
Log (growth of prefectural government expenditure)	0.0798 [2.25]**	0.0798 [2.25]**	0.0753 [2.07]**	0.0781 [2.21]**	0.0772 [1.82]*	0.052 [1.61]	0.0655 [1.79]*	0.0655 [1.79]*	0.0608 [1.61]	0.0655 [1.79]*	0.063 [1.28]	0.030 [0.94]	0.0506 [1.33]	0.0506 [1.33]	0.0415 [1.06]	0.0379 [1.01]	0.046 [2.86]***	0.015 [0.49]
Log (growth of prefectural private capital stock)	1.2223 [8.09]***	1.2223 [8.09]***	1.7231 [9.48]***	1.0736 [7.50]***	0.9351 [10.63]***	1.070 [9.40]***	1.1991 [7.66]***	1.1991 [7.66]***	1.6908 [8.88]***	1.2517 [7.85]***	0.9407 [11.35]***	1.035 [8.67]***	1.2127 [7.24]***	1.2127 [7.24]***	1.7851 [8.81]***	1.5434 [8.28]***	0.8997 [8.59]***	[7.18]***
Log (Total amount of prefectural damage) (lagged 10)	-0.0483 [-2.68]***	-0.0483 [-2.68]***	-0.0869 [-3.42]***	-0.0488 [-2.84]***	-0.075 [-4.72]***	-0.087 [-4.88]***												
Log (Total amount of prefectural damage) (lagged 11)							-0.0457 [-2.38]**	-0.0457 [-2.38]**	-0.0711 [-2.60]***	-0.0455 [-2.34]**	-0.0712 [-4.50]***	-0.074 [-4.39]***						
Log (Total amount of prefectural damage) (lagged 12)													-0.0317 [-1.55]	-0.0317 [-1.55]	-0.0473 [-1.68]*	-0.0333 [-1.52]	-0.0632 [-3.34]***	-0.073 [-3.03]***
_cons	-0.7134 [-2.28]**	-0.7134 [-2.28]**	-1.1406 [-3.09]***	-0.5722 [-1.93]*			-0.6598 [-2.00]**	-0.6598 [-2.00]**	-1.1703 [-3.01]***	-0.7096 [-2.11]**			-0.8039 [-2.24]**	-0.8039 [-2.24]**	-1.5132 [-3.59]***	-1.0651 [-2.70]***		
N	692	692	692	692	692	692	644	644	644	644	644	644	598	598	598	598	598	598
R-squared	0.2313		0.2393	0.2729	0.7769		0.2065		0.2044	0.1945	0.7585		0.1947		0.202	0.1372	0.7382	
Adj-R-squared	0.2269		0.18	0.2687			0.2015		0.1373	0.1895			0.1893		0.1291	0.1314		
AR(1)						0.002						0.007						0.005
AR(2)						0.304						0.325						0.409
Hansen Test						0.194						0.142						0.157

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

Table 3-10: Estimation result 5

Dependent Variable: Growth of gross prefectural domestic product

	N=558						N=517						N=482					
	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	PCSE	System GMM one step
Log (Growth of gross prefectural domestic product) (Lagged)	0.1493 [3.19]***	0.1493 [3.19]***	0.0425 [0.84]	-0.1 [-2.13]**	0.1745 [3.27]***	0.094 [1.32]	0.1375 [2.82]***	0.1375 [2.82]***	0.0242 [0.46]	-0.0992 [-2.03]**	0.1682 [2.72]***	0.100 [1.42]	0.1378 [2.74]***	0.1378 [2.74]***	0.0126 [0.23]	0.1917 [3.84]***	0.1639 [3.00]***	0.074 [0.96]
Log (growth of prefectural government expenditure)	0.0571 [1.42]	0.0571 [1.42]	0.0438 [1.05]	0.0418 [1.06]	0.0552 [0.94]	0.025 [0.78]	0.0697 [1.53]	0.0697 [1.53]	0.0459 [0.98]	0.0517 [1.17]	0.0569 [1.00]	0.018 [0.51]	0.1057 [2.15]**	0.1057 [2.15]**	0.0671 [1.31]	0.1116 [2.26]**	0.1018 [2.20]**	0.062 [1.60]
Log (growth of prefectural private capital stock)	1.2892 [7.33]***	1.2892 [7.33]***	1.8865 [8.66]***	1.6759 [8.52]***	0.8499 [8.76]***	0.930 [7.67]***	1.3217 [7.15]***	1.3217 [7.15]***	2.0062 [8.80]***	1.7131 [8.29]***	0.9095 [8.78]***	1.006 [7.03]***	1.2702 [6.51]***	1.2702 [6.51]***	2.0095 [8.24]***	1.1713 [6.18]***	0.8555 [7.03]***	1.005 [7.05]***
Log (Total amount of prefectural damage) (lagged 13 years)	-0.0124 [-0.58]	-0.0124 [-0.58]	-0.012 [-0.40]	-0.0034 [-0.15]	-0.0563 [-2.77]***	-0.055 [-2.99]***												
Log (Total amount of prefectural damage) (lagged 14 years)							-0.0262 [-1.14]	-0.0262 [-1.14]	-0.0582 [-1.81]*	-0.0236 [-0.96]	-0.0691 [-3.21]***	-0.072 [-2.84]***						
Log (Total amount of prefectural damage) (lagged 15 years)													-0.0257 [-1.05]	-0.0257 [-1.05]	-0.0437 [-1.30]	-0.0264 [-1.10]	-0.0698 [-3.09]***	-0.080 [-3.96]***
_cons	-1.1173 [-2.97]***	-1.1173 [-2.97]***	-1.9992 [-4.46]***	-1.5272 [-3.74]***			-1.0725 [-2.67]***	-1.0725 [-2.67]***	-1.8067 [-3.86]***	-1.4482 [-3.31]***			-1.08E+00 [-2.54]**	-1.08E+00 [-2.54]**	-1.98E+00 [-3.97]***	-9.78E-01 [-2.37]**		
N	558	558	558	558	558	558	517	517	517	517	517	517	482	482	482	482	482	482
R-squared	0.1964		0.2026	0.1375	0.7239		0.2059		0.2231	0.1612	0.7165		0.2067		0.2225	0.2312	0.6995	
Adj-R-squared	0.1906		0.124	0.1313			0.1997		0.1397	0.1546			0.2		0.1323	0.2248		
AR (1)						0.011						0.004						0.011
AR (2)						0.370						0.267						0.342
Hansen Test						0.079						0.206						0.146

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

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Table 3-11: Estimation result 6

	Pooled	Random Effect	Fixed Effect	PCSE	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	System GMM one step
Log (Growth of gross prefectural domestic product) (Lagged)	0.118	0.118	-0.0068	0.1531	0.042	0.0975	0.0975	-0.0415	-0.2775	0.519	0.0969	0.0969	-0.0632	-0.2524	0.033
	[2.24]**	[2.24]**	[-0.12]	[4.80]***	[0.55]	[1.71]*	[1.71]*	[-0.67]	[-4.97]***	[0.66]	[1.59]	[1.59]	[-0.95]	[-4.20]***	[0.40]
Log (growth of prefectural government expenditure)	0.1219	0.1219	0.0841	0.1126	0.055	0.1142	0.1142	0.0696	0.0491	0.241	0.0998	0.0998	0.0589	0.0381	0.033
	[2.30]**	[2.30]**	[1.52]	[3.47]***	[1.37]	[2.04]**	[2.04]**	[1.18]	[0.96]	[0.57]	[1.65]	[1.65]*	[0.92]	[0.67]	[0.77]
Log (growth of prefectural private capital stock)	1.3256	1.3256	2.0471	0.8516	1.354	1.4871	1.4871	2.3084	2.1901	1.063	1.5602	1.5602	2.4188	2.1794	1.138
	[6.31]***	[6.31]***	[7.84]***	[5.97]***	[9.00]***	[6.40]***	[6.40]***	[7.97]***	[8.11]***	[8.04]***	[6.21]***	[6.21]***	[7.77]***	[7.42]***	[7.03]***
Log (Total amount of prefectural damage) (lagged 16 years)	-0.0232	-0.0232	-0.0494	-0.073	0.083										
	[-0.89]	[-0.89]	[-1.35]	[-2.81]***	[-4.86]***										
Log (Total amount of prefectural damage) (lagged 17 years)						-0.017	-0.017	-0.0529	-0.0151	-0.088					
						[-0.58]	[-0.58]	[-1.30]	[-0.49]	[-4.16]***					
Log (Total amount of prefectural damage) (lagged 18 years)											-0.0116	-0.0116	-0.0435	-0.0301	-0.108
											[-0.35]	[-0.35]	[-0.95]	[-0.86]	[-4.18]***
_cons	-1.22	-1.22	-2.0287	-		-1.5396	-1.5396	-2.4196	-2.2477		-1.7227	-1.7227	-2.6862	-2.1494	
	[-2.69]***	[-2.69]***	[-3.78]***	-		[-3.02]***	[-3.02]***	[-3.93]***	[-4.00]***		[-3.11]***	[-3.11]***	[-4.03]***	[-3.44]***	
N	437	437	437	437	437	394	394	394	394	394	350	350	350	350	350
R-squared	0.2075		0.2256	0.6754		0.2161		0.2475	0.1892		0.2204		0.2547	0.1978	
Adj-R-squared	0.2002		0.1253			0.208		0.1378	0.1808		0.2113		0.13	0.1885	
AR (1)					0.017					0.016					0.026
AR (2)					0.382					0.264					0.426
Hansen Test					0.117					0.073					0.053

(Source: the author)

Table 3-12: Estimation result 7

	Pooled	Random Effect	Fixed Effect	prais-winsten	System GMM one step	Pooled	Random Effect	Fixed Effect	prais-winsten	System GMM one step
Log (Growth of gross prefectural domestic product) (Lagged)	0.0924	0.0924	-0.0675	0.2641	0.047	0.0576	0.0576	-0.0963	0.2733	0.0334
	[1.44]	[1.44]	[-0.92]	[4.21]***	[0.50]	[0.81]	[0.81]	[-1.20]	[4.01]***	[0.42]
Log (growth of prefectural government expenditure)	0.1371	0.1371	0.0979	0.1557	0.061	0.102	0.102	0.0384	0.112	0.0134
	[2.03]**	[2.03]**	[1.32]	[2.31]**	[1.16]	[1.37]	[1.37]	[0.46]	[1.51]	[0.25]
Log (growth of prefectural private capital stock)	1.5011	1.5011	2.2993	1.1347	0.943	1.4333	1.4333	2.2543	0.929	0.9764
	[5.66]***	[5.66]***	[6.67]***	[4.69]***	[5.22]***	[4.65]***	[4.65]***	[5.70]***	[3.37]***	[5.31]***
Log (Total amount of prefectural damage) (19 year lag)	0.0155	0.0155	0.0012	0.0149	-0.081					
	[0.42]	[0.42]	[0.02]	[0.44]	[-2.69]***					
Log (Total amount of prefectural damage) (20 year lag)						0.0016	0.0016	-0.0426	-0.0044	-0.0911
						[0.04]	[0.04]	[-0.69]	[-0.12]	[-2.81]***
_cons	-1.9553	-1.9553	-2.9552	-1.5617		-1.7103	-1.7103	-2.4644	-1.0749	
	[-3.47]***	[-3.47]***	[-4.35]***	[-2.98]***		[-2.61]***	[-2.61]***	[-2.97]***	[-1.83]*	
N	308	308	308	308	308	263	263	263	263	263
R-squared	0.2115		0.2352	0.2875		0.1546		0.1849	0.2131	
Adj-R-squared	0.2011		0.0864	0.2781		0.1415		-0.0074	0.2009	
AR (1)					0.022					0.017
AR (2)					0.365					0.214
Hansen Test					0.054					0.025

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

Chapter 4: The Role of Social Capital after Disasters: An Empirical Study of Japan based on Time-Series-Cross-Section (TSCS) Data from 1970 to 2009

Introduction

After the recent Great East Japan Earthquake of March 11, 2011, especially in the Japanese media, the importance of community and bonds has been heavily stressed for disaster prevention and recovery. But, why are these types of bonds (*kizuna* in Japanese) so important? To understand the importance, we use the literature on social capital as a conceptual framework. A growing number of studies in economics and sociology have already been discussed the effect of social capital on economic behavior (Putnam, 2000; Coleman, 1988; Narayan 1999; Durlauf and Fafchamps 2005; Cardenas and Carpenter 2008; Aoki 2010).[82]

However, we do not know how the effect of social networks works exactly, especially in the process of recovery after disasters. Intuitively, the importance of social networks is understandable, but to formulate recovery policy and plans, it is essential to precisely understand the precise role of social capital in recovery. It is known, for example, that certain communities recover more quickly than others within disaster-hit regions, such as in the city of Kobe, Japan, after the 1995 earthquake (Edgington 2010; Yasui 2007; Healey 2009). Yet, what it the precise role of community bonds in this type of recovery?

Regarding which factors contribute to economic recovery following a disaster, views are divided among past studies (Aldrich 2011, 2012). For instance, research conducted by Dacy and Kunreuther (1969), and Kates and Pijawka (1977), argued that infrastructure restoration best determines the speed of recovery. Against this argument,

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[82] The benefits of social capital do not necessarily extend to those outside the immediate social network. The outcomes of social capital can be not only positive, but also negative (e.g. India's caste system).

Aldrich (2011, 2012) and Tatsuki (2007) discussed that social capital plays more significant roles in the process of recovery, rather than physical infrastructure. Horwich (2000) examined the economic recovery process after the Great Hansin Earthquake in 1995 and argued that a fundamental factor in any recovery is human capital rather than physical capital. He also argued that the quality of governance matters. Further, some authors discussed that the significant factors assisting are: the quantity of money flowing in to a disaster hit region (Vale and Campanella 2005); and the region's socio economic and demographic conditions (e.g. how much inequality existed) (Katz 2006). In sum, there is no consensus as to the precise factors that contribute to recovery, and the relative weight of different factors is likely to vary according to the specific context and disaster region. The aim of this study is to examine the role of social capital for recovery, using TSCS (Time-Series-Cross-Section) data from all 47 prefectures of Japan for 40 years from 1970 to 2009.

1. Literature Review

Regarding how social capital works after disaster in recovery process, we identified three mechanisms that show how social capital works in disaster recovery (as shown in Table 2-1 in Chapter 2. 1) (Aldrich 2012). These are: (1) it provides informal insurance for the local community; (2) it encourages collective action in order to overcome post-disaster problems; and (3) social capital decrease in the probability of exit of residents from the stricken neighborhood after a sever disaster.

One of the difficult issues in analyzing social capital in a particular place is how to measure it. The difficulty stems from the context-specific characteristics of social capital and the complication of its theorization and operationalization. There is very limited number of empirical studies on the role of social capital after disasters. Despite the

difficulties there are several possible proxies for social capital in existing data. Aldrich (2011) conducted a quantitative study on the Great Hanshin-Awaji Earthquake using the number of NPOs (Nonprofit Organizations) created per capita as a proxy for social capital and population growth as a proxy for recovery. The paper tested five variables thought to impacts on recovery. These are social capital, earthquake damage, population density, economic conditions, and social inequality. He found that the amount of social capital (number of NPOs) is the strongest determinant for rates of recovery in 9 wards of Kobe city.

Unlike Aldrich's approach, focusing on a specific case study on the recovery process, Yamamura (2010) conducted quantitative analysis using panel data from Japan's 47 prefectures, covering 14 years from 1988 to 2001. He investigated the roles of social capital in reducing damages from natural disasters and he also dealt with the preventive side of the role of social capital, rather than the post-disaster recovery process. Yamaura's paper also examined whether experiencing natural disasters affected individual and collective protection on disasters expected in the future to prevent the damages. As proxies of social capital, Yamamura's paper used the number of pubic baths, community centers, and community fire-fighting teams. These variables were divided by population to normalize (per capita values). There were three conclusions: 1) high level of social capital variable were associated with alleviation in damages caused by natural disasters; 2) the risk of natural disasters made people act more collectively and, hence, social capital was effective to preventing disasters and 3) income level were also important factors for decreasing damages, but this had little influence in the case of small disasters.

There are a very limited number of quantitative papers on disaster-related social capital. As far as this thesis aware, Aldrich's paper is the only econometric study on social

capital and post-disaster recovery of Japan.[83] So, this thesis intends to expand his discussion, applying his methodology to panel data of Japan's prefectures.

2. Framework and Data

This chapter employs the autoregressive distributed lag (ADL) model, following Aldrich (2011).

$$Y_{i,t} = \alpha_i + \beta Y_{i,t-1} + \gamma_0 Dis_{i,t} + \gamma_1 \log SC_{i,t} + \gamma_2 \log X_{i,t} + \varepsilon_{i,t}$$

$Y_{i,t}$ is the population growth (or decline) rate. The i is a prefectural index to capture prefecture-specific effects, and the t is the time index. This chapter uses this variable as an index of recovery. There are many possible proxies for recovery. Those are economic, demographic, infrastructure indices. Among those proxies, population recovery is an essential part of disaster recovery (Vale and Campanella, 2005; Edgington, 2010). Vale and Campanella (2005:12) argued that 'the numerical resilience of the population may be a reasonable proxy for recovery. For cities that have lost huge percentages of their populations, the restoration of the city as a place of habitation itself a significant achievement.' For example in the case of the Great Hanshin Awaji Earthquake, which occurred in Kobe in 1995. There was a sharp population decline and it took almost ten years to recover to the pre-earthquake 1994 population level. Aldrich (2011) also used population growth as an index for his empirical study. With regard to post-disaster recovery, there are two types of population growth: natural increase and social increase. Both typed of population growth are important to recovery from disasters. Hence, basically this chapter also uses population growth as an index of recovery. To control the long term trend, this model includes $Y_{i,t-1}$ as independent variable in right hand side of the equation.

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[83] Aldrich (2012) studied case studies of Indian Ocean Tsunami of 2004, Hurricane Katrina of 2005, and the Tokyo Earthquake (Great Kanto Earthquake) of 1923.

$Dis_{i,t}$ is the *measure* for disaster prefecture-specific effects. Regarding the disaster damages, this chapter employs a death toll number by disasters. To normalize, the number is divided by population, as death toll relative to population. Here, the disaster is natural disasters such as earthquake, storm and flood damages. The data is from Fire and Disaster Management Agency, available from the Government of Japan (2013). Past literature uses several disaster measures, such as the number of disasters (Skidmore and Toya 2002; Sawada et al. 2011). The measure, however, is difficult to capture the heterogeneous nature of disaster impacts. Rather than the number of disasters, its magnitude and location of disasters are more important factors for indicating relative size of the damages. Even for a huge earthquake, if the epicenter is in remote area, the damage will be small. It is extremely difficult to construct data set to capture all these heterogeneous nature of disaster. Instead of the number of disasters, this chapter employs the number of death toll caused by disasters. The death toll data seems to be a more appropriate disaster measure since the number represents how severe the disaster was. Employing this variable, we can equally treat any disasters irrespective of the nature of disasters such as earthquake and flood.

$SC_{i,t}$ is the social capital variable. Among the available government data, this chapter selected the following three variables as proxies, considering the proxies argued by Yamamura (2010). This chapter uses 'the number of community centers per 1 million citizens' and 'the proportion of the voluntary organization for disaster prevention households voluntarily organizing disaster prevention groups, *Jisyubosai-soshiki* in Japanese, among all households in Japanese' as proxies for social capital.

The number of community centers per 1 million citizens was selected because it provides places for people to gather and socialize. As Putnam (2000) discussed, with a place to talk and socialize with other community members, people tend to collaborate to take collective action trusting each other (Yamamura 2010). Further, this chapter employs

the proportion of the voluntary organization for disaster prevention households voluntarily organizing disaster prevention groups among all households in the prefecture. The voluntary organization for disaster prevention is voluntary organization unlike the government established community fire-fighting teams (*Syobo-dan*). In Japan, community disaster management was originated in the *Edo* period (1603‑1868) as a part of group responsibility within a community. Now it has become very common in the contemporary period when participation rate has steadily increased over the years. Throughout Japan there are posters and/or slogans advocating the importance of the community in managing disasters. The disaster prevention groups engage in informal fire-fighting drills and act as substitutes for public fire-stations. This variable was chosen because it is considered to be high only in a community with high social capital. If social capital is low, people do not cooperate.

$X_{i,t}$ is the control variable related to recovery. Those are human capital investment (educational expenditure) and recovery investment data (disaster recovery expenditure). Because of the variance of the data constructed on $SC_{i,t}$ and $X_{i,t,}$, the analytical function above takes log on both variables.

The database is constructed based on the data available from the Government of Japan (2013) (Table 2). Prefectural death toll relative to population includes death caused by natural disasters such as earthquake, storm, flood damage, heavy snow, high tide, tsunami and eruption. As these damages happen every year, some of them are major disasters, but most of them are minor and death toll is small. That is why the variable with relative to population is very close to zero. The data set is unbalanced TSCS (time-series cross section) data, covering all 47 Japanese prefectures for 40 years from 1970 to 2009.

Hence, the data set include some major disasters such as the Great Hanshin Awaji Earthquake which killed 6434 people in 1995, Offshore Southwestern Hokkaido earthquake and Tsunami to Okujiri islands, killed 202, in 1993 and typhoon in 1982 that killed 427, among other small natural disasters.

As Beck (2004) and Beck and Katz (2004) discussed, there are critical differences between TSCS and panel data. One of these is incidental parameters. Many panel methods have been developed to tackle this problem, but this is not the case for TSCS. TSCS is different from the panel data panels, which have a large number of cross-sections with t ($n>t$), where t is time series and n is cross section variable. TSCS data have reasonable-sized t and a not very large number of cross sections ($t>n$). According to Beck and Katz, the cutoff level could be that TSCS has more than $20t$, and panel data has fewer than $10t$. Following Aldrich (2012), the population growth data is panel data including pre-disaster period to capture disaster impacts.

Table 4-1: Descriptive statistics and source of data

Variable	Observation	Mean	Std. Dev.	Min	Max	source of data
Prefectural population growth	1833	1.003533	0.007189	0.9876616	1.050616	Cabinet Office, Government of Japan
Prefectural death toll relative to population	1881	0.0000026	0. 0000278	0	0.0011624	Cabinet Office, Government of Japan
Proportion of households participating the voluntary organization for disaster prevention among all households	1363	41.2314	27.45062	0.5	99.9	White Paper, Fire Defense Agency (each year)
Number of community centers per 1 mil. citizens	1475	172.1622	182.934	1	1043.6	Cabinet Office, Government of Japan

(Source: the author)

3. Methodology

This chapter employs four methods to estimate results. Those are: standard panel analysis (fixed effects estimation, random effects estimation and pooling estimation); Prais-Winstein Regression; two-step system GMM and PCSE (panel-corrected standard error). Prais-Winsten (PW) estimation is employed since the model could be biased with the inclusion of lagged independent variable in the estimated panel. The PW estimation is multiple linear regressions with AR (1) and exogenous explanatory variables. The PW standard errors account for serial correlation, which fixed effects estimation does not. The PCSE improves on OLS standard errors with respect to panel heteroskedasticity and contemporaneous correlation of the errors (Beck and Katz 2004).

The system GMM is used to tackle other possible biases by endogeneity and omitted variables in addition to the bias. In our system GMM estimation, the lagged dependent variable is considered to be endogenous. Arellano and Bond (1991) first established the 'difference-GMM' estimator for dynamic panels (Roodman, 2003). Arellano and Bond's estimation starts by transforming all regressors via differencing, and uses the Generalized Method of Moments (GMM). This method regards lagged dependent variables as not exogenous but predetermined. A problem with the original Arellano-Bond difference-GMM estimator is that if there is an issue of a random walk of endogenous variables, the estimation becomes a biased coefficient estimation

To tackle the above problem, Blundell and Bond (1998) articulated an improvement on augmented difference GMM by Arrelano and Bover (1995), adding more assumptions that first difference of instrument variables are uncorrelated with the fixed effects, allowing more instruments to be introduced and making them exogenous to the fixed effects. The augmented estimator is called "system GMM." The major advantage of the system-GMM estimation, compared with the difference-GMM, is that it effectively

controls autocorrelation and heteroskedasticity. This chapter implements the Hansen test for joint validity of the instruments, and also implements the AR test for autocorrelation.

4. Estimation Results

Table 4-2 presents the estimated coefficients for the six models tested on the data set. Model 1 to 3 use standard panel data analyses: fixed effects estimation, random effect estimation and pooling estimation. The previous year's population growth rates proved to be highly significant. The results of social capital variables among those three estimations are mixed. The number of community centers pre one million people becomes positive in any of these three estimations. On the other hand, the proportion of households which joined the voluntarily organizing disaster prevention groups became negative in fixed effects, and positive in random effects and pooling estimations.

Among the standard panel analyses, which estimate is better estimation? The results of F-test, Hansen test and Breusch and Pagan test mean that fixed effects model is the most appropriate model. The F-test result (Prob>F=0.000) indicates that the fixed effects model is more appropriate than the pooling regression model. Considering this, the Breusch and Pagan test and the Hausman test were implemented. The Breusch and Pagan test result (Prob > chibar2 =1.0000) indicates that the pooling regression model is more appropriate than the random-effects model. The Hausman test result (Prob>chi2 = 0.0000) means the fixed effects model is better than the random effects model. Thus, the results of three tests mean that the fixed effects model is the most suitable.

The result of fixed effect model is, as discussed above, different from our expectation. Even if number of community center became positive, voluntarily organizing disaster prevention groups was negative. In addition, death toll was also not statistically significant. The standard errors, however, do not account for serial correlation, and

possibly became a biased estimator in this case.

Thus, next, Model 4 employs PCSE to improves on OLS standard errors with respect to panel heteroskedasticity and contemporaneous correlation of the errors (Beck and Katz 2004). This model confirms that voluntarily organizing disaster prevention groups have positive impacts.

As discussed, the model could be biased due to the presence of lagged independent variable in the estimated panel. Model 5 used PW estimation. This model confirms both social capital variables, number of community center and voluntarily organizing disaster prevention groups, are positive. Further, this model catches the negative impacts of death toll. Just, it needs to note that the coefficient of death toll is much bigger than the social capital variables. This means that even though social capital has positive impacts, it is difficult to recover fully just by social capital. This thesis will come back to this point later.

Further, to confirm the result of PW estimation, Model6 used two step system GMM to handle the possible biases by endogeneity and omitted variables. The p value of the Hansen J statistic and the Arellano-Bond statistic (AR(2)) imply that the instruments are orthogonal to the error term and that the error term is not auto-correlated in the system GMM estimation. The estimation result confirms the result of PW estimation. The death toll proved to be highly significant, and social capital variables become positive.

5. Conclusion

This chapter quantitatively examined the roles of social capital in disaster recovery. The estimated results of both Models 5 and 6 confirmed that social capital variables had positive impacts, handling possible biases. This is a statistically robust result indicating that social capital played a certain role in post-disaster recovery in Japan between 1970 and

2002.

It still needs to note that the coefficient of social capital alone is very small especially compared with the negative impact of death toll. This indicates that even though social capital has positive impacts, it is difficult to recover fully just by social capital. This means, probably, that, as discussed in Chapter2, social capital needs to be used linking with other capital such as physical capital and human capital. These linkages will produce multiplier effect to recovery to make the process quicker. That is the way Tohoku needs to be rebuild, and the recovery plan needs to have the strategy centering social capital and linking it with infrastructure and education.

Table 4-2: Coefficients for three models of population growth rate
Dependent variable: Prefectural population growth

|	Model1 Fixed Effects	Model2 Random effects	Model3 Pooling	Model4 PCSE	Model5 Prais-Weinstein	Model6 Two-step System GMM
Prefectural population growth (lagged)	0.7974	0.942	0.942	0.9988	0.9457	0.9973
	[60.02]***	[129.64]***	[129.64]***	[2615.56]***	[135.05]***	[12027.90]***
Prefectural death toll relative to population	-2.8031	-9.0792	-9.0792	-6.5969	-8.5248	-4.6501
	[-0.59]	[-1.86]*	[-1.86]*	[-1.36]	[-1.75]*	[-2.07]**
log (Proportion of households voluntary organizing disaster prevention movement among all households)	-0.0001	0.0001	0.0001	0.0001	0.0001	0.0004
	[-1.69]*	[2.43]**	[2.43]**	[2.00]**	[2.52]**	[24.38]***
log (number of community centers per 1 million citizens)	0.0003	0.0001	0.0001	0.0001	0.0001	0.0002
	[11.69]***	[4.52]***	[4.52]***	[1.22]	[4.41]***	[25.84]***
_cons	0.2014	0.0569	0.0569		0.0533	
	[15.09]***	[7.82]***	[7.82]***		[7.59]***	
N	1295	1295	1295	1295	1295	1295
R-squared	0.8807			1.000	0.988	
Adj-R-squared	0.8759				0.9881	
AR(1)						0.000
AR(2)						0.673
Hansen test						0.801
F test	Prob > F = 0.0000					
Hausman test	Prob>chi2 = 0.0000					
Breusch and Pagan test	Prob > chibar2 = 1.0000					

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

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Chapter 5: Have Social Capital Promoted Economic Reconstruction Since the Great Hanshin Awaji Earthquake? - A Quantitative Study of Social Capital on the Tertiary Sector of Kobe

Introduction

At 05:46 on January 17, 1995, a powerful earthquake (magnitude 7.3), occurred in the Kobe region, killing 6,434 people and destroying more than 200,000 homes. Soon after the disaster, the rebuilding effort for the 3 million victims began. 1.2 million volunteers came to assist the victims. This was the first major earthquake to hit an urban area in modern times in Japan since the Tokyo Earthquake (Great Kanto Earthquake) of 1923. It is estimated that the cost of the damage to the area's industry was around 5 trillion yen, of which direct damage to business property and equipment accounted for half, while indirect damage such as business closures accounted for the rest (Kuramochi 1997).
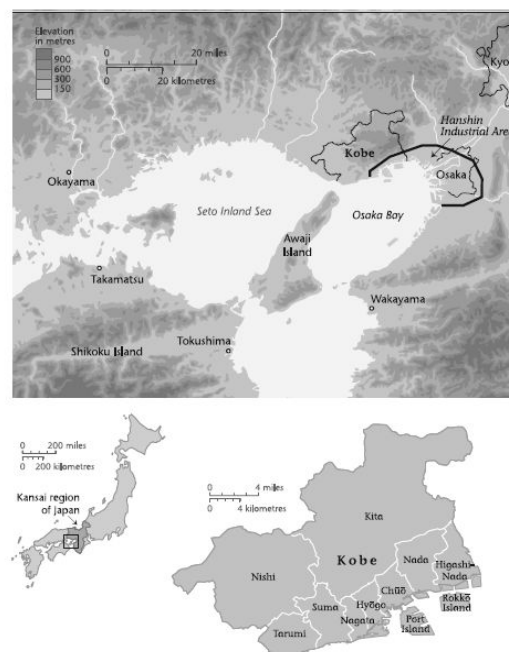
Figure 5-1: Map of Kobe

(Source: adopted from Edington (2010), originally from Fujimori (1980))

Eighteen years have passed since the earthquake. Has Kobe fully recovered from the earthquake and rebuilt its economy? How should we assess its reconstruction? If it has been reconstructed, what factors contributed to it? The objective of this chapter is to revisit the experience of the Great Hanshin Awaji Earthquake.

1. 18 years after the Disaster. Did Kobe recover and reconstruct?

Did Kobe fully recover from the earthquake 18 years ago? This is a question difficult to answer in one word, as we discussed in Chapter 1 and will see more in detail later. Let us look at Kobe from the viewpoint of resilience, which we discussed in previous chapter2. Resilience has been discussed heavily in last few years. The question is whether Kobe sprang back to where it was before the earthquake. As discussed, this thesis conceptualizes the post-disaster recovery stage into two phases: 'recovery' and 'reconstruction.' The recovery phase is the short-term period directly after a disaster. This term could last from several months to several years depending on the magnitude of the disaster. Recovery essentially restores the basic functions of society in the best possible way under the circumstances (McCreight 2010). Those who left the disaster area come back to live in the area again. One of the important indicators of recovery is population growth, as discussed.

On the other hand, the reconstruction phase is not simply about recovering the basic functions, but about re-creating a new and vibrant society. The reconstruction phase is crucial to sustaining recovery and putting economic activities back on track. The reconstruction phase is a mid- to long-term. The reconstruction phase could include activities to create new industry (or culture and history, among other things). This is because it is not possible to return everything. Lost lives never come back. Those who survived the earthquake need to move on, remembering the dead, but creating a new

society and history.[84]

As indices for recovery and reconstruction, this thesis focuses on population growth and employment because these are the most important factors of recovery and reconstruction respectably. As we will see, one of the immediate impacts of disaster is on the population. People move out from the affected area. There are two types of these people. The first is those who evacuate to temporary housing or relatives' house; and as it takes time to reconstruct their house and work place, some of them are forced to start a new life, getting a job in a new place. Then, in many cases people decide to stay at the new place rather than go back as they have their new job, and their children go to a new school nearby with new friends. As time goes by, the chance to go back gets less and less. This is what happened in Kobe. The second is people who move out from the affected area to avoid possible future disasters that could strike again. Sometimes people just move to a new home and stay in the same job, but some people find another job in another location.

Here, the job is the key to people's movement in mid and long term reconstruction phase. Population growth and job are inseparable. Jobs give income for people to spend, and then local stores can start to sell products. These two cogs are especially important in the phase of reconstruction beyond recovery, without this mechanism, no economy will be able to succeed in either recovery or reconstruction. Since this chapter will focus on the reconstruction phase, we will focus on employment of Kobe.

The population of Kobe declined drastically the year the disaster occurred. Compared with the previous year, the population declined by around 95,000 inhabitants. In this figure were the 6,434 people killed in the earthquake; the rest, around 85,000, moved out from Kobe. As the years went by, the population gradually returned. Almost a decade

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[84] Kates and Pijawka (1977) categorized this into four stages: emergency, restoration, replacement reconstruction, and developmental reconstruction. In my framework, the first three phases are all related to the recovery phase, and 'developmental reconstruction' is the start of the reconstruction phase.

after the earthquake, the population of Kobe recovered to its pre-disaster level (fig. 5-2) in 2004. However, ward by ward data shows a different picture (fig. 5-3). As the map of Kobe shows there nine wards in Kobe (fig. 5-1 in p112). Among nine words, east parts of coastal wards were damaged very hard (Higashi-nada, Nada, Chuo, Hyogo, and Nagata) and west parts of coastal wards and mountainous words were relatively less affected (suma, tarumi nishi and kita). There is a stark difference on death toll ratio between the two groups (Table 5-1). What are the factors contributing to this difference among the wards of Kobe?
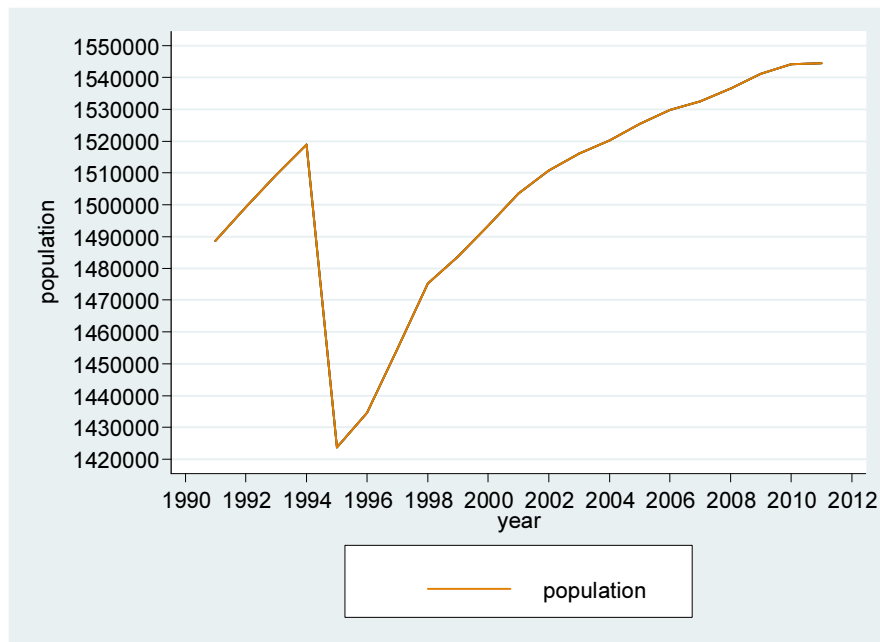
Figure 5-2: Population of Kobe

(Source: by the author based on statistics of the city of Kobe (2013))
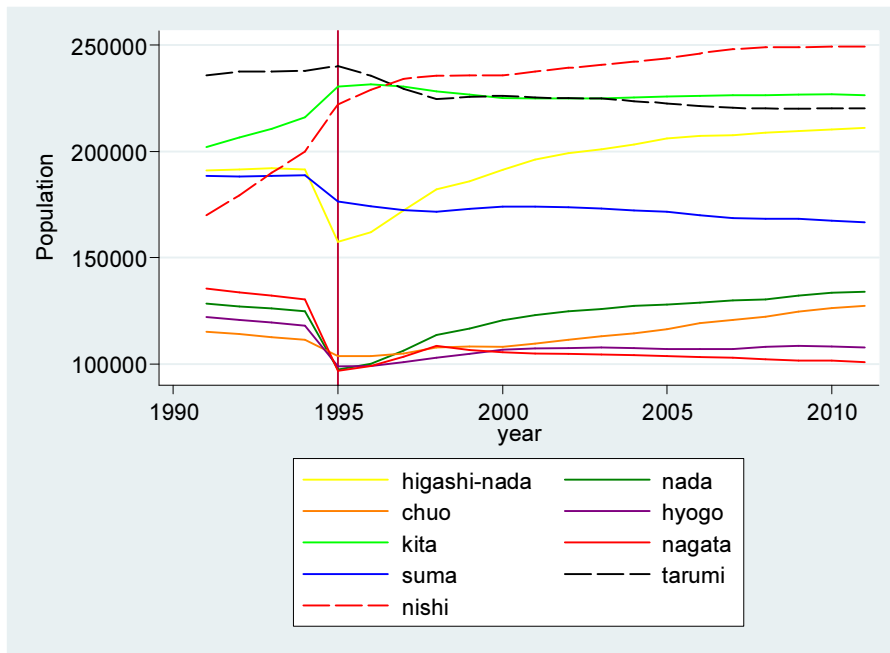
Figure 5-3: Population of Kobe by ward

(Source: by the author based on statistics of the city of Kobe (2013))

Table 5-1: Death toll by Wards

	Death toll	Population	Death toll ratio (Death toll/population)
Higashi-nada	1,471	157,599	0.933
Nada	933	97,473	0.957
Chuo	244	103,711	0.235
Hyogo	555	98,856	0.561
Nagata	919	96,807	0.949
Suma	401	176,507	0.227
Tarumi	25	240,203	0.010
Nishi	11	222,163	0.005
Kita	12	230,473	0.005

(Source: by the author based on statistics of the city of Kobe (2013))

So, does the magnitude of damage affect population growth trends after the disaster? As Figure 5-3 shows, in terms of the population trend, the wards of Kobe can be categorized into four types: (1) population declined after the earthquake, but bounced back well (Higashi-nada, Nada, Chuo); (2) population declined after the earthquake, and

continue to decline (Nagata); (3) population decline was small (in other words, damage was small) at the time of the earthquake, but population continued to decline (Suma, Tarumi); and (4) almost no impact (Kita, Nishi). Hence, population growth trend after the disaster has nothing to do with the impact of the disaster. Nishi and Kita wards were less affected, so it is natural for people to move to these wards. However, even though Tarumi was affected less than other wards, its population continues to decline. The wards in the first category were hit harder, but the population growth after the earthquake was much faster than in the other wards. In other words, the recovery situation is mixed. It is not easy to say in one word if Kobe has recovered or not because of this mixed picture.

So, how was economic recovery of Kobe? Figure 5-4 shows that after the earthquake its economy quickly got better mostly because of the investment in reconstruction. However, the economic trend soon reversed and declined in terms of gross output. Further, the gap between Kobe and the rest of Japan widened until 2003.[85] After 2004, the economic trend in Kobe equaled that of the rest of Japan, but still hasn't totally 'filled the gap.' Gross output had also recovered to its pre-disaster level in 2004, the same as the population. This overall picture, however, needs to be looked at in more detail industry by industry.[86]

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[85] The data show that the trend in Hyogo Prefecture, to which Kobe belongs, is similar to that of Kobe. This is probably because most of the prefecture's economic activity is concentrated in Kobe.
[86] Beniya, Hokugo and Murosaki (2007) analyzed local industries such as artificial leather shoes industry cluster, and concluded that the industry of Kobe had not yet fully recovered.

1994 = 100
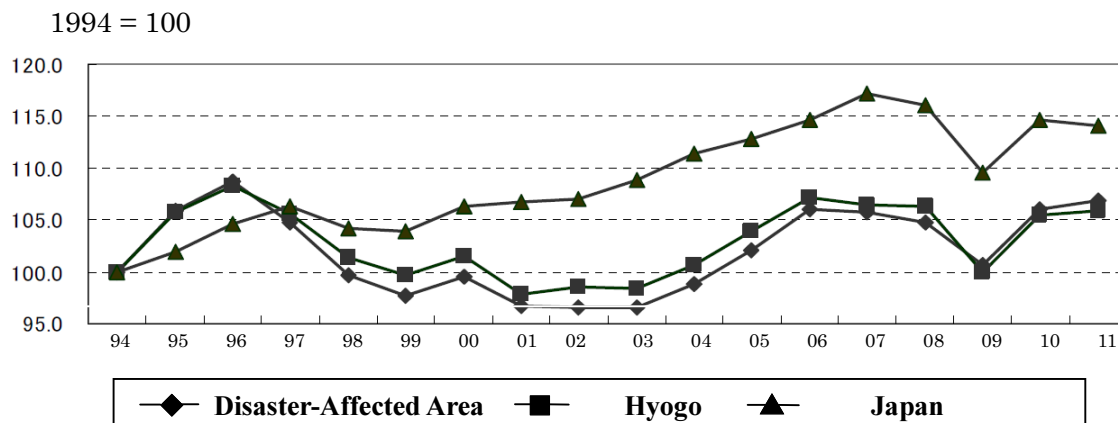
**Figure 5-4:** **Time-series data on gross output**
(Source: edited by the author based on Hyogo 2013)

Figures 5-5 and 5-6 show the share of the working population in secondary and tertiary sectors, respectively. Figures 5-7 and 5-8 show the numbers of people working in both sectors. It is very clear that after the disaster, there was a working population shift from the secondary sector to the tertiary sector. The secondary sector has not recovered to the pre-disaster level. The drop is especially steep in Nagata Ward, where huge number of small factories producing artificial leather shoes were traditionally located, as an industrial cluster. According to Yamaguchi (2013), before the earthquake, there were around 450 shoe manufacturers and around 1,680 related companies employing 15,000 people. The earthquake completely or partially destroyed 90% of those companies. The loss from the earthquake was estimated at 300 billion yen (Seki and Ohashi 2001). So, the impact was huge. Part of the reason for the loss was due to fires after the earthquake. The artificial leather shoes factories use chemicals such as paint thinner, which is highly flammable. According to the Japan Chemical Shoes Industry Association, it is reported that sales of the associated companies had dropped from 70 billion yen to around 45 billion yen, and employment from 6,500 people to below 3,000 in 2010.
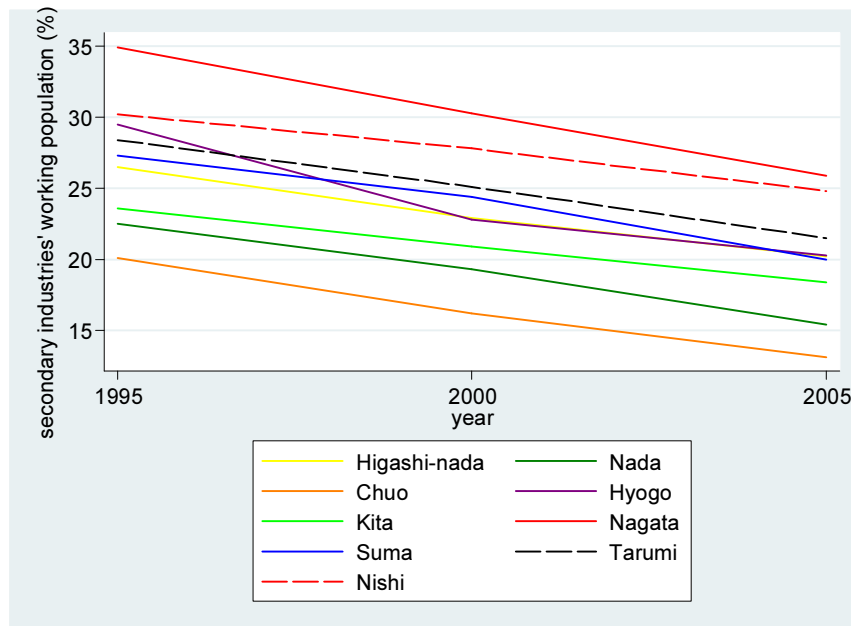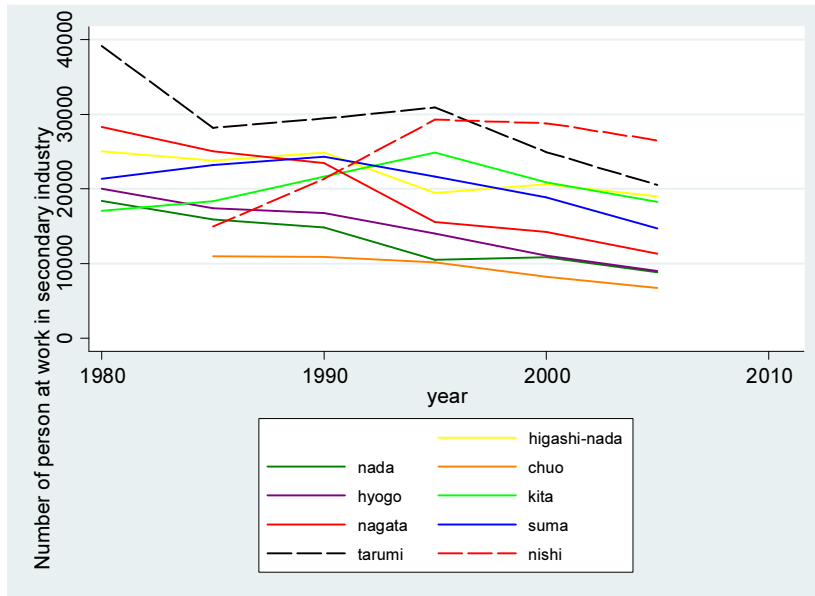
Figure 5-5: Percentage of the working population in secondary industries
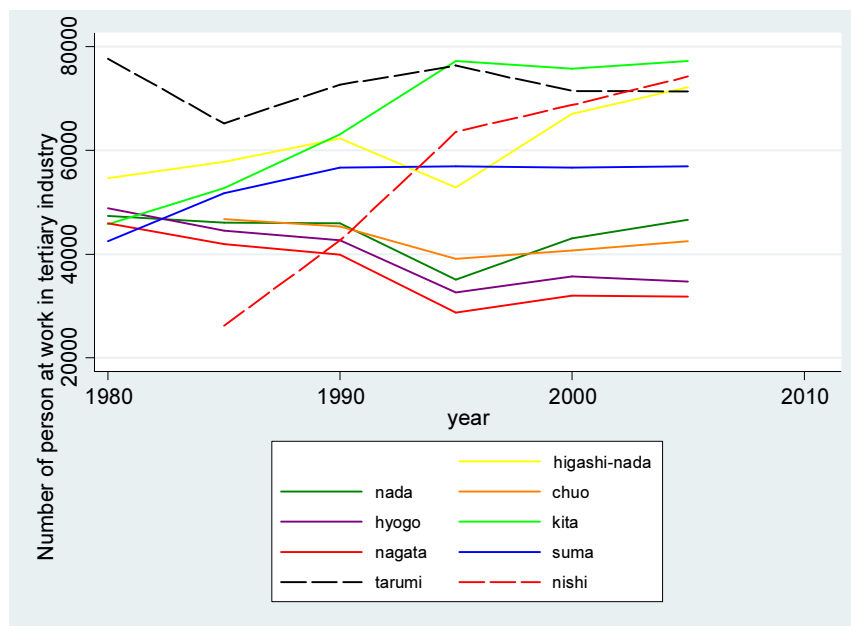
(Source: by the author)
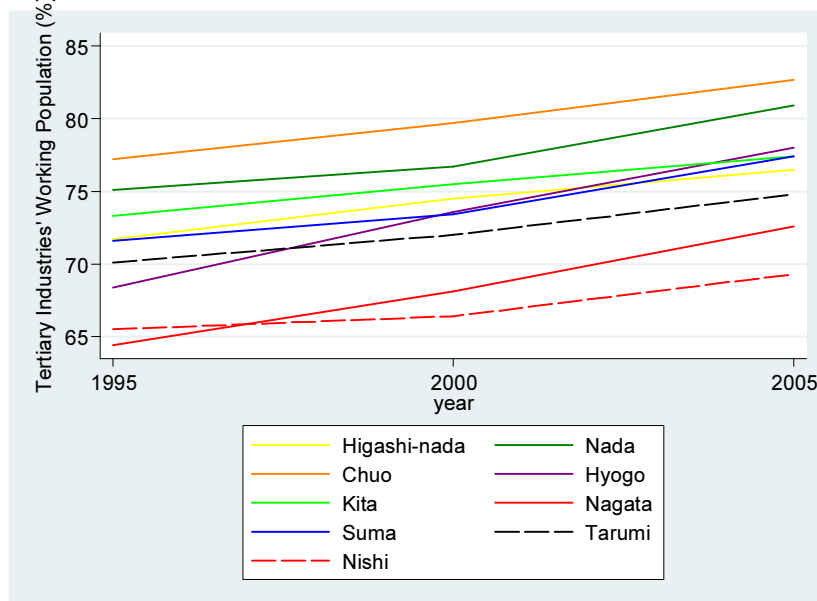
Figure 5-6: Percentage of the working population in tertiary industries

(Source: by the author)

Figure 5-7: Number of people working in secondary industries
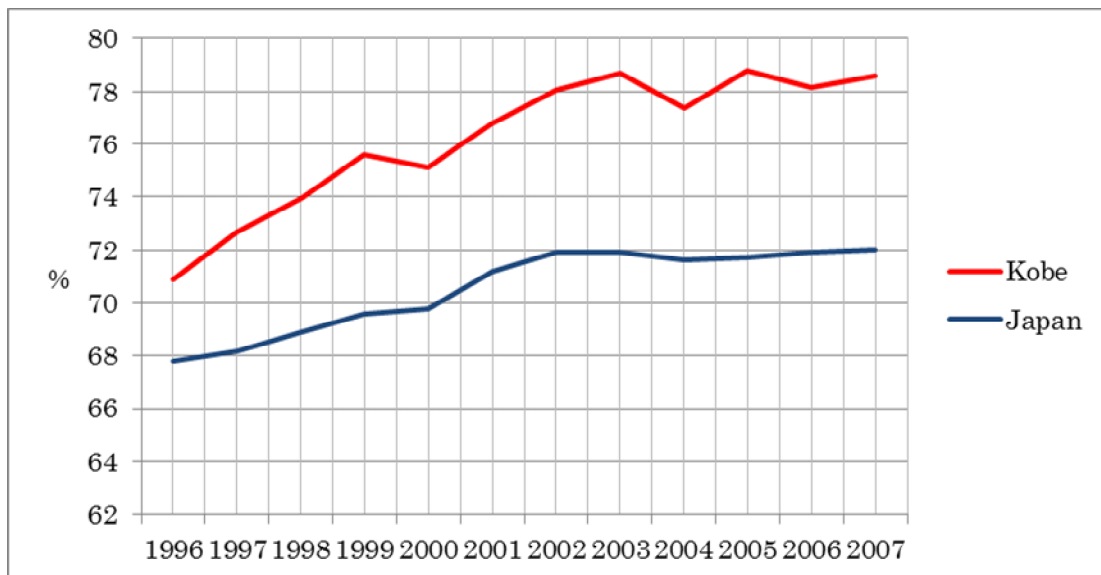
(Source: by the author)

Figure 5-8: Number of people working in tertiary industries

(Source: by the author)

On the other hand, the tertiary sector recovered well and in most wards the number of people working in this sector has increased beyond pre-disaster levels. According to the statistics of the city of Kobe (2006 and 2009), the medical and welfare

industries, and education support and service sectors have grown very fast both in the number of offices and employment.[87] In terms of employment, the tertiary industry accounted for 83.5% of total employment in 2006.[88] As of 2012, the medical and welfare industry alone employed 13% (93,618 people) of those employed in Kobe.

This shift of industrial structure to tertiary industry is significant compared with the overall Japan (fig 5-9). As the figure shows the tertiary industry of Kobe has expanded rapidly since 1996 starting from 70.8% to 78% in 2009 compared with the rate of expansion for overall Japan. One important aspect is that in the case of Kobe, the expansion is largely the first 8 years (1996 - 2003) after the earthquake in 1995.
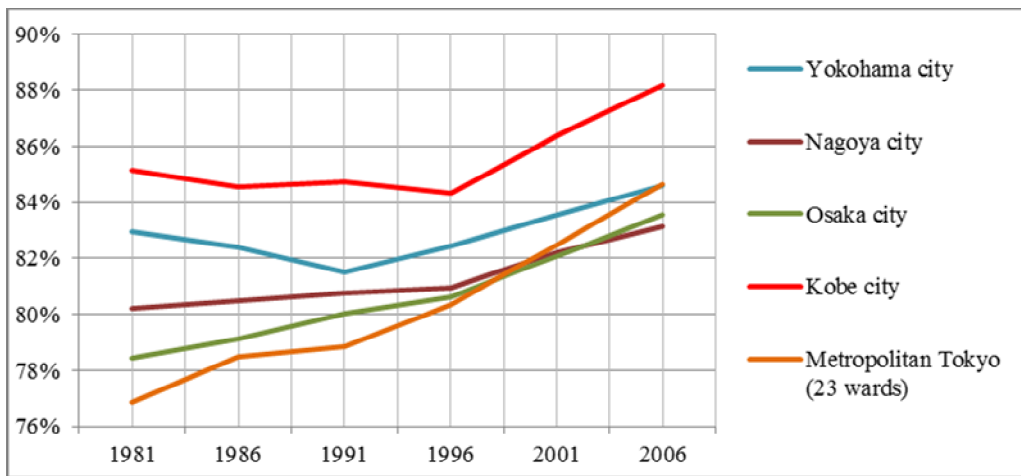

Figure 5-9: Share of tertiary sector
(Source: by the author based on the database of the Gov. of Japan 2013 and the City of Kobe 2013)

Now, let us look at the third tertiary sector of Kobe in comparison with other major urban cities of Japan. Figure 5-10 shows the ratio of tertiary sector offices among all industries. The ratio of Kobe has been high compared with other major cities, but the ratio has been slightly declining before the earthquake. This trend suddenly changed since the

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[87] The number of those employed in the manufacturing industry declined.
[88] It is 0.1% and 16.4% for the primary industry and secondary industry, respectively.

earthquake, turning to upward trend drastically. The same is true to the ratio of employees working in tertiary sector (fig. 5-12). The trends among major cities have been the same. In the case of Kobe, the trend was slightly different from other cities. The ratio is higher compared with other major cities excluding Tokyo metropolitan area, but before the earthquake it became flat. After the earthquake, the trend has regained its momentum and became steeper than other cities. As we have discussed, it would be reasonable to say that in Kobe tertiary sector was the driver of economic recovery.

Figure 5-10: Ratio of tertiary sector offices
(Source: by the author based on the database of the Gov. of Japan 2013b)
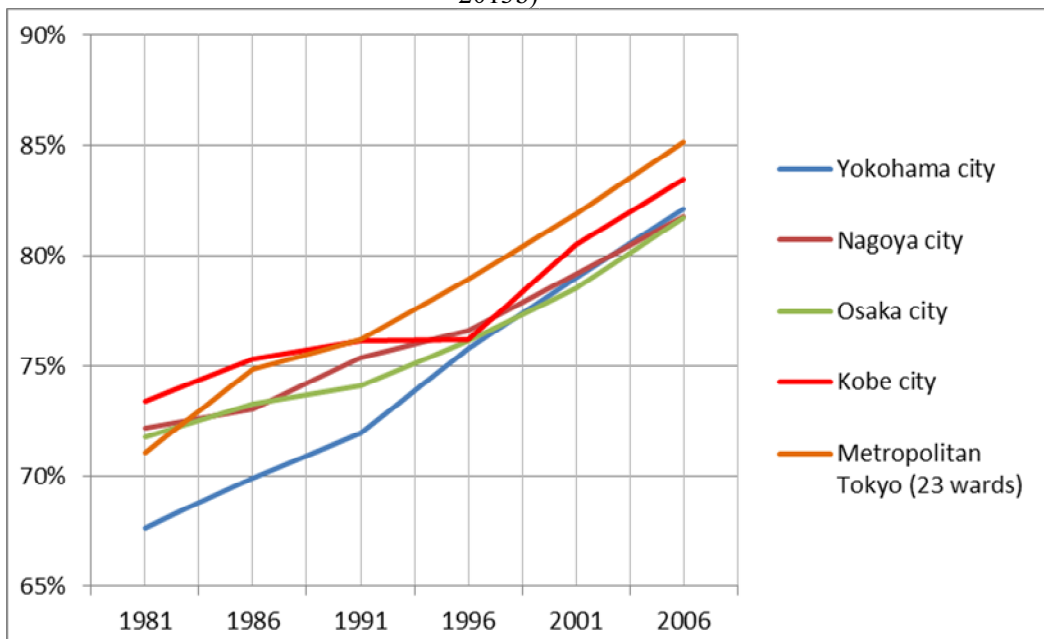
Figure 5-11: Ratio of tertiary sector employee
(Source: by the author based on the database of the Gov. of Japan 2013b)

One of the reasons for the development of the tertiary sector is Kobe Bio-medical Innovation Cluster (KBIC) at Port Island. So far, more than 220 companies have invested in KBIC. KBIC was initiated by the city of Kobe in 1998 soon after the earthquake as a part of the recovery plan. Once the cluster developed, the economic effects spilt over to related industries, employing more people in those industries. Then, as the population grew, business opportunities increased for small business such as retail shops and restaurants. This dynamic process of development will have a huge economic impact through multiplier effects.

Furthermore, another aspect upon which the city of Kobe focused was community business, providing public support to those who initiate the initiatives. Community business has become active with the help of public intervention (Ozawa 2000). Many successful cases have been reported such as TOR-Road Town Planning Corporation (utilizes vacant stores for glassware sales as well as town planning consultation), and Hyogo Transfer Service Network (helps disabled and senior people to move).

Aside from these sub-sectors, attention needs to be paid to the fact that according to the economic census of Kobe in 2009, more than 90% of offices in Kobe employ less than 20 workers. In other words, SMEs are the driver for economic reconstruction, providing jobs through multiplier effects.

Regarding the population growth and employment, this chapter investigated how these two variables correlated in Kobe. It turned out to be linearly correlated, as Figure 5-13 shows. Figure 5-14 checked how these two variables relate in time-series, ward by ward. This result also confirms that the two variables strongly correlate with each other. Just as we discussed, the causality of the two occurs in two ways, multiplying the effects.

These variables are two cogs that can drive the economy and act as important factors for mid- and long-term reconstruction.
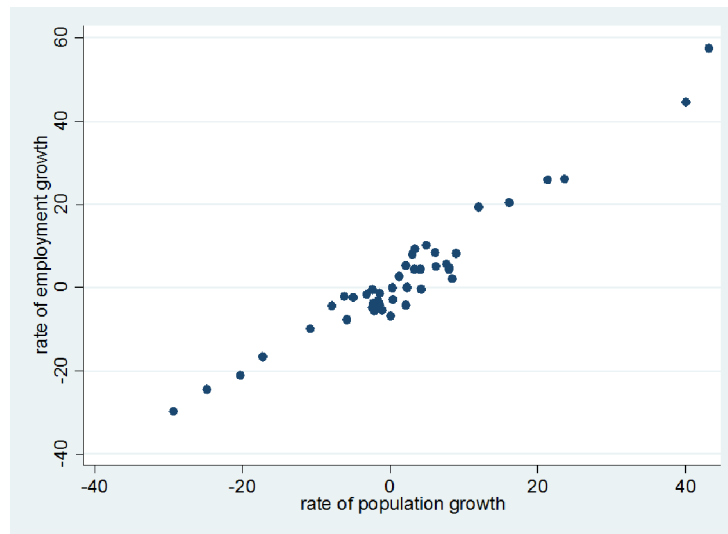
Figure 5-12: Population growth rate and employment growth rate of Kobe

(Source: the author)
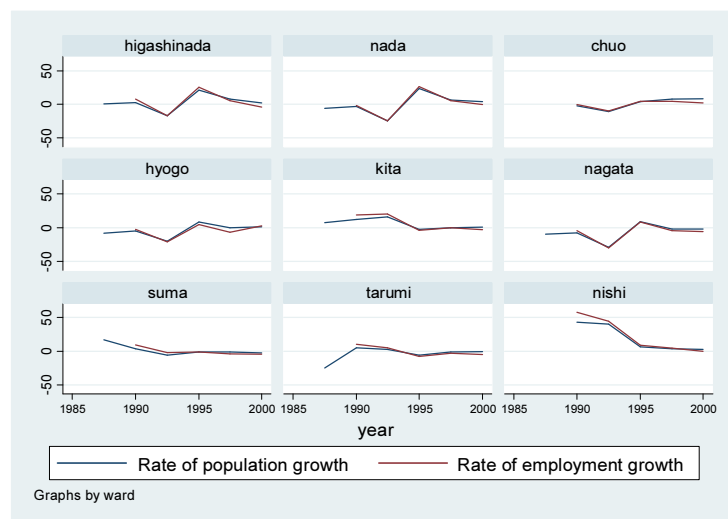
Figure 5-13: Population growth rate and employment growth rate of Kobe by Ward

(Source: the author)

As we have seen, population growth and employment are two most important factors for reconstruction, and the data show a mixed picture of recovery and reconstruction among sectors. This is why it is difficult to say in one word whether Kobe

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has recovered or not as the situation in each ward and sector is different. As we discussed, after the earthquake, a structural change in industry occurred, shifting from the secondary industry to the tertiary industry. This chapter focuses on the tertiary sector. How does social capital play roles to promote the sector?

2. Literature Review

There is a vast amount literature dedicated to post-earthquake Kobe (Horwich 2000; Seki and Ohashi 2001; Hayashi 2011; Hayashi (eds) 2011; Sawada and Shimizutani 2008; Aldrich 2011; Edington 2010; Shibanai 2007).

One of the characteristics of the post-Great Hansin Earthquake discourse was the emphasis of social capital. The city of Kobe formed a Social Capital Study Group in 2006, inviting social scientists as advisors, and in 2011 they published a report just before the Great East Japan Earthquake. The Study Group organized a workshop among stakeholders, and studied the Mano area, a downtown section with resident area and artificial leather shoes industrial cluster, and the northern part of Noda in Kobe's Nagata Ward. The report found that the local community organization was a catalyst between the city administration and residents, which was critical in the process of recovery. Further, the study group concluded that the community functioned well even before the earthquake, and that people actively participated in the reconstruction process.

From the Study Group, a number of articles were published on social capital in the city of Kobe, such as Shibanai (2007) and Tatsuki (2005, 2007). The former uses elementary school areas as the unit for social capital, which seems to be a useful alternative to disaggregate prefectural data since much of the community effort centers on elementary schools in Japan. The latter proposed the Seven Elements Model of life recovery for the Kobe earthquake. These seven elements are: housing, social ties, townscape,

physical/mental health, preparedness, economic/financial situation, and relation to government. He found that these seven critical elements accounted for nearly 60% of the life recovery variance. Nakagawa and Shaw (2004) also studied the Mano area and found that there is a positive correlation between higher satisfaction rate of a community on new town planning and the speedier recovery of the community. Aldrich (2011) employed econometric analysis to study the impact of social capital for population growth and found out that the amount of social capital (measured by NPOs (Nonprofit Organizations) created per capita) most strongly determines recovery rates.

As we have seen, a great number of studies have been carried out on social capital and recovery in Kobe in the post-disaster phase. What seems to be lacking, however, is analysis of the mid- and long-term reactivation phase. Social capital is considered to promote the start of business (Nam, Sonobe, and Otsuka 2010; Todo, et al. 2013).[89] There are four causal relations, as discussed in detail in Chapter 2. These are: 1) job matching; 2) business information and technology transfer; 3) provide access to distant markets; and 4) transaction cost reduction. The issues in the reconstruction phase are chronic problems the community faced even before disasters, but that have been amplified by disasters, rather than the acute external shock itself. As discussed before, jobs are the important factor for reconstruction.

On the four causal relationships, as discussed in chapter 2, two common factors are crucial. One is to decrease asymmetry of information. Under this condition, it is know that market fails and investment becomes less than desirable level (underinvestment) (Dasgupta and Stiglitz, 1988; Stiglitz 2010 and 2012). Social capital complements this

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[89] The benefit of accumulation is not confined to the manufacturing sector, but can be applied to the service sector as well. Shopping streets are one particular case. After the Great East Japan Earthquake, where to re-open stores in the tsunami-affected area became an issue. There is no point in opening a store that is isolated from other stores. They cannot return to their original location, but it has taken a long time to decide where communities should be moved and where offices should be established. So, it is difficult to decide on where shopping streets should be located.

market failure. As entrepreneur gets more information from social network, it decreases asymmetry of information, and, therefore, promotes investment.

The other is to promote knowledge transfer among network to make industrial cluster more competitive (Inkpen and Tsang 2005; Urata and Itoh 1994). Knowledge is considered as public goods, and should be essentially zero marginal cost. In the real world, however, knowledge is not always free and public good. Rather, it is protected under the property rights, suggesting existing of monopoly. It is known from Otsuka and Sonobe (2011a) and related various empirical studies (Sonobe, Suzuki, and Otsuka 2011; Kuchiki and Tsuji 2008) that without introducing new ideas and knowledge, industrial cluster never sustainably grow. This is because profitability of the pioneer firms starts decrease as imitators are attracted to the business. If this trend continues, the profitability of many firms further decrease, and eventually, the number of companies in the industrial cluster will decrease. Keeping in mind the importance of social capital, the public and private sectors were collaboratively established organizations such as Hanshin Awaji Industrial Rehabilitation Promotion Organization and the New Industry Research Organization (NIRO). These organizations intended to construct social networks among the private sectors and between public and private sectors to promote innovation in the disaster hit area. Their activities were reviewed as having achieved its purpose to a certain degree (Kato 2011).

3. Testable Hypothesis

In social capital literature, the concept has been categorized into two types: bonding and bridging. The bonding is a network binding a community together (e.g., family, neighborhood). The bridging is characterized by the heterogeneity of membership and openness to others. In other words, it is a network between bonding networks.

There are negative as well as positive aspects. Social capital promotes, as discussed in the last section, knowledge transfer, reducing the transaction cost of the market. On the other hand, it could exclude others. The typical case is the mafia and the caste system in certain parts of South Asia. This is particularly true for bonding social capital. It could end up with nepotism and crony capitalism, which causes market failure and hampers the healthy development of the private sector and employment growth.

To translate these arguments into a testable hypothesis, this chapter postulates the following hypothesis:

Hypothesis: Both bonding and bridging aspects of social capital promote reconstruction

promoting business and growth of employment.

4. Methodology

To test the above hypotheses, this chapter employs the following equation. The dependent variable is the employment growth rate in the tertiary industry ($Emp_{i,t}$), where i and t denote ward and time respectively. This variable is chosen because employment is the most suitable index for the mid and long term reconstruction phases.

$$\Delta Emp_{i,t} = \alpha_i + \beta \Delta Emp_{i,t-1} + \gamma_0 SC_{i,t} + \gamma_1 HC_{i,t} + \gamma_2 \Delta population\_growth_{i,t} + \varepsilon_{i,t}$$

Following the New Keynesian Philips Curve (NKPC) literature (Taylor 1979; Calvo 1983), in the labor market, wages, prices and employment levels are assumed to be volatile, and adjustment to market equilibrium is gradual. This assumption is appropriate to Japan's labor market, where lifetime employment is common. This assumption is different

from that of the neo-classical Phillips curve. Therefore, the equation contains lagged $Emp_{i,t}$.

The model with a lagged Y variable is known as an autoregressive model (Beck and Katz 2009).

$SC_{i,t}$ is social capital variable, and $HC_{i,t}$ is human capital. As the social capital variable, the following three proxy variables will be used. As we discussed in Chapter 2 on the proxies used in past literature, due to limited availability of data, this chapter uses the following proxies. The proxy for bridging social capital is 'crime rate' and 'the number of community centers,' and that of bonding is 'number of third generation household members living together (=number of third generation household members/number of all household members in a ward). '

Table 5-2: Variables for bridging and bonding social capital

Bridging	Bonding
- Crime rate	- Households with three generation living together

(Source: the author)

The crime rate is selected because communities with high social capital are considered to have a lower crime rate (Putnam 2001; Akcomak and Weel 2008; Buonanno, Montolio and Vanin 2009; Deller and Deller 2010). The study conducted by the Cabinet office of the Government of Japan (2003) also uses crime rate as a proxy for social capital. In a community with high social capita, members feel they have a responsibility for the security of the neighborhood to protect their families. They organize community meetings, walking patrols, and inform the police if they have spotted any suspicious figures (Aldrich 2012). Coleman (1988: S104) stated that 'effective norms that inhibit crime make it possible to walk freely outside at night.' Without tight community control, it would be difficult for parents to send their children to play outside. Here, a ward is a gathering of small communities. Since the crime rate is lowered by the collective effort of communities,

it is regarded as a bridging form of social capital.

As a bonding social capital (within a network), this chapter will use the number of households with third generation living together because those households are considered to have strong family tie, and provide social safety net. Recently, Abe (2013) conducted comprehensive study on Japan's poor in 2007 and 2010, and found that household structure is very important factor of poverty. According to her study, among all households, poverty rate is highest in households with single parent and children, followed by households of single old person. On the contrary, households with third generation living together are the lowest in terms of poverty rate. This is because in households with third generation living together, household member helps each other. In other words, social safety net is rich in these households. This is clear example of bonding social capital. As discussed, however, the strong within network does not necessary mean the benefit is shared to outside of the network.

population growth$_{i,t}$ is the rate of population growth. Population growth and employment are considered to be closely associated. The causality is not one way, but is probably two ways. People will come back to the area where there are employment opportunities. At the same time, if people move in, the need for various consumer products and goods increases. This creates good business opportunities for SMEs, increasing demand for labor. *disaster*$_{i,t}$ is the variable relating to damage caused by the disaster. Here, we will use the death toll rate (= death toll number/population).

This chapter used the standard panel estimation (random effects (RE); fixed effects (FE); pooling cross section across time), Prais-Winstein estimation and system GMM (Generalized Method of Moments). Since this model is a dynamic model containing a lagged *Y*, this chapter uses a Prais-Winstein estimation to ensure the findings. Prais-Winsten is a method of multiple linear regression with AR (1) and exogenous

explanatory variables. The Prais-Winsten standard errors account for serial correlation, which the FE, RE and pooling estimations do not.

The system GMM is used to tackle other possible biases by endogeneity and omitted variables in addition to the bias. In our system GMM estimation, all regressors are considered to be endogenous. Arellano and Bond (1991) first established the 'difference-GMM' estimator for dynamic panels (Roodman, 2003). Arellano and Bond's estimation starts by transforming all regressors via differencing, and uses the Generalized Method of Moments (GMM). This method regards lagged dependent variables as not exogenous but predetermined. A problem with the original Arellano-Bond difference-GMM estimator is that if there is an issue of a random walk of endogenous variables, the estimation becomes a biased coefficient estimation

To tackle the above problem, Blundell and Bond (1998) articulated an improvement on augmented difference GMM by Arrelano and Bover (1995), adding more assumptions that first difference of instrument variables are uncorrelated with the fixed effects, allowing more instruments to be introduced and making them exogenous to the fixed effects. The augmented estimator is called "system GMM." The STATA command *xtabond2* implements both estimations.

The major advantage of the system-GMM estimation, compared with the difference-GMM, is that it effectively controls autocorrelation and heteroskedasticity. This chapter implements the Hansen test for joint validity of the instruments, and also implements the AR test for autocorrelation.

5. Data

For the empirical study, this chapter uses the variables listed in Table 5-3. The database is unbalanced panel data, covering all 9 wards of Kobe from 1995 to 2010, with some gaps.

These data are from the existing data of the city of Kobe (2006; 2012; and 2013) and census data of the Government of Japan (2013). There are two types of data on households with third generation living together. Both are population rate. One is number of member of the household, and the other is the number of households. This is just to double check the findings. Regarding crime rate, the data on crime is the number of offences such as murder, robbery, and rape. It does not include a number of minor offences and traffic accidents. Population rate of university graduates is human capital proxy, and university graduates number is divided by population.

Table 5-3: Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Growth rate of number of employment in tertiary industry	36	1.022868	14.42606	-27.88066	49.23398
Population Growth Rate	36	1.305278	12.75325	-29.28	40.1
Rate of third generation household member living together	36	3.679265	1.647733	1.366254	7.535136
Rate of third generation household living together	36	7.318844	2.6601	3.576982	13.6769
Crime Rate	27	0.0228495	0.0152815	0.0091299	0.0729566
Population rate of graduated from universities	18	15.9988	4.502186	8.613366	25.93723

(Source: the author)

6. Estimation Results

Table 5-4 and 5-5 show estimation results. Models 1 to 4 of Table 5-4 show that rate of member of third generation living together becomes significantly positive. Further, the human capital variable (population rate of university graduates) also becomes positive. To double check the importance of social capital, this chapter also used the rate of household

third generation living together (Models 5 to 8). In these models, to increase N, human capital variable (graduates from universities) is excluded. The ward by ward data on graduates from universities is collected once in ten years. The results of these models confirm the same results. The lagged growth rate in employment in the tertiary industry becomes negative. This is probably because the demand for labor will decrease against the labor demand in the last term, according to the diminishing marginal returns for labor. Among the estimations, pooling is a better method than random effect and fixed effect, judging from the results of the Hausman test, F-test, and Breusch and Pagan. The population growth rate is also positive in all estimations.

Then, this chapter checked the effects of crime rate. Model 9 and 10 did not become statistically significant by the estimations. Models 11 and 12 of Table 5-5 show that the crime rate is negatively correlated with unemployment and statistically significant by Prais-Winstain. In other words, if the crime rate is lower thanks to high social capital, then it has positive impacts on employment.

Finally, considering the possible endogeneity and omitted variables biases, Model13 checked the results with the system-GMM (one step), and confirmed that both third generation living together and crime rate became significant. Hence, regarding social capital variable, it would be able to say that these are robust results. Therefore, the results are concordant with the hypotheses on bonding (Number of third generation members living together), bridging (represented by crime rate), which were proved to be statistically significant.

Table 5-4: Estimation results 1 (Dependent variable: Growth rate of number of employment in tertiary industry)

	Model1	Model2	Model3	Model4	Model5	Model6	Model7	Model8
	FE	RE	pooling	Prais-Winsten	FE	RE	pooling	Prais-Winsten
Growth rate of number of employment in tertiary industry (lagged)	-0.1258 [-1.27]	-0.2827 [-2.88]***	-0.2827 [-2.88]***	-0.2828 [-2.98]**	-0.0748 [-1.28]	-0.0454 [-1.05]	-0.0454 [-1.05]	-0.061 [-1.45]
Population growth	1.0167 [6.27]***	0.9007 [6.08]***	0.9007 [6.08]***	0.8978 [6.25]***	1.001 [5.40]***	1.1604 [11.84]***	1.1604 [11.84]***	1.1762 [14.81]***
Rate of households third generation living together					4.1397 [3.62]***	1.5247 [3.57]***	1.5247 [3.57]***	1.4519 [4.46]***
Rate of member of third generation living together	2.6208 [1.80]	1.6006 [模98]***	1.6006 [4.98]***	1.6155 [6.52]***				
Population Rate of graduates from Universities	0.0944 [0.07]	0.465 [2.00]**	0.465 [2.00]**	0.4777 [2.09]*				
_cons	-21.8751 [-0.69]	-20.6893 [-4.05]***	-20.6893 [-4.05]***	-20.9307 [-4.30]***	-15.4135 [-4.16]***	-6.9821 [-4.25]***	-6.9821 [-4.25]***	-6.4107 [-5.10]***
N	18	18	18	18	27	27	27	27
R-squared	0.9828	0.9491		1	0.8898			0.9009
Adj-R-squared	0.8762	0.9415		1	0.809			0.888
F test	F(8, 5) = 2.23		Prob > F = 0.1961		F(8, 15) =1.29		Prob > F = 0.3179	
Breusch and Pagan Lagrangian multiplier test for random effects	chibar2(01)=0.00	Prob > chibar2 =	1.0000		chibar2(01) = 0.00		Prob > chibar2 = 1.0000	
Hausman Test	chi2(4) =27.37	Prob>chi2 =	0.0000		chi2(3) = 5.29	Prob>chi2 =	0.151	

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

Table 5-5: Estimation results 2 (Dependent variable: Growth rate of employment in tertiary industry)

	Model 9	Model 10	Model 11	Model 12	Model13
	RE	pooling	Prais-Winsten	Prais-Winsten	System GMM
Growth rate of number of employment in tertiary industry (lagged)	-0.0394 [-0.89]	-0.0394 [-0.89]	-0.072 [-1.71]	-0.0007 [-0.02]	-0.0276 [-1.03]
Population growth	1.1478 [11.20]***	1.1478 [11.20]***	1.2018 [15.89]***	1.1005 [18.03]***	1.1193 [11.93]***
Crime Rate	-1.4083 [-0.03]	-1.4083 [-0.03]	-60.7822 [-2.02]*	-74.9522 [-3.21]***	-89.5034 [-4.94]***
Rate of member of third generation living together	0.8926 [3.26]***	0.8926 [3.26]***	0.7153 [3.98]***		0.1401 [2.09]**
Growth rate on member of third generation living together				0.3542 [5.76]***	
Population rate of graduates from universities					
_cons	-7.8562 [-3.17]***	-7.8562 [-3.17]***	-4.834 [-2.95]***	-30.481 [-5.53]***	
N	27	27	27	27	27
R-squared			0.9174	0.9475	
Adj-R-squared			0.9023	0.9379	
Hansen test					0.999
Sargan test					0.386
Arellano-Bond statistic					0.415

* p<0.1, ** p<0.05, *** p<0.01

(Source: the author)

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Conclusions

Our analysis of employment in the tertiary industry of Kobe after the earthquake proves that social capital is important factors for employment. Furthermore, we disaggregated aspects of social capital into bonding and bridging in order to analyze the data, and empirical studies proved the hypothesis to be correct.

In Tohoku, people have been forced to leave their communities because of the tsunami and the Fukushima nuclear plant accident (destruction of social capital), so the question of how to re-strengthen bridging as well as bonding social capital will be key to recover and reconstruction. This chapter provides empirical evidence for the on-going debate on how to rebuild Tohoku.

Chapter 6: Conclusions and Policy Implications to the Great East Japan Earthquake

The last three chapters investigate macro-economic impacts of disasters and the roles of social capital in the process of recovery and reconstruction in the framework of resilience. Chapter 3 found, contrary to the past literature, the economic impacts of disaster is negative and last long. Chapter 4 and 5 proved that if a community has higher social capital, then it benefitted population recovery and employment increase, both are important factor for recovery and reconstruction respectively. Chapter 5 also found that both bridging and bonding social capital equally plays the role. Therefore, social capital has vital roles to play after disasters. The next question that comes to mind is what are the policy implications for the Great East Japan Earthquake and possible future disasters?

What happened to Tohoku, hit by the Great East Japan Earthquake, was destruction of community (or social capital) on a huge scale. The tsunami after the earthquake hit the coastal region hard. Many people lost their families, relatives, and friends. People were moved to temporary shelters, but this time, thanks to the lessons learned from Kobe, the allocation of temporary shelters was much better. In Kobe, the allocation of victims to temporary shelter was random. Many old people lost ties which had existed before the earthquake, and eventually died alone ("lonely death" or *kodokushi* in Japanese) in temporary shelters. In many cases, nobody noticed their deaths, and they were found months later.

In addition to the direct impacts, there were indirect impacts as well. In the tsunami-hit area, there was the question as to whether to rebuild the community again in the same area, which might be hit by a tsunami in the future, or whether to rebuild it on

higher ground, away from the original area. Views differed among community members. Some people insisted that they should go back to the original place to maintain their community. However, others were against this because it might result in further victims in the future. Almost two and half years after the earthquake, there are still many communities where opinions are divided about where to rebuild. Furthermore, because of the time it has taken to make a decision, people have started to move away from shelters to rebuild their lives, getting jobs, buying houses, and entering schools in a new place. This indirect impact slowly destroys communities. This situation is further complicated in Fukushima as a result of the nuclear power plant accident. People have been forced to evacuate. Cities inside the evacuation zone have decamped to other cities, with all their administrative structures and work since nobody has been allowed to stay.

Hence, in Tohoku, the community has been destroyed on a large huge scale as a result of the earthquake, tsunami, and the nuclear power plant accident. Population is still flowing out of the area as Figures 6-1 and 6-2 show. Figure 6-1 shows data for the national average, three Tohoku prefectures (Miyagi, Iwate, and Fukushima), and the coastal region of these three prefectures which were hit hardest by the disaster. Figure 6-2 shows that the decline is much greater in the coastal area. This shows the declining trend is similar in the coastal area of these three prefectures. This population movement is totally different to that of Kobe. It took ten years for Kobe to bounce back to its pre-disaster population level. If we look at the ward-by-ward data of Kobe (fig. 5-3 in Chapter 5), however, the picture is slightly different from that overall (fig. 5-2). The population pattern in Tohoku is similar to that of Nagata ward in Kobe, in that the population continued to decline after the disaster, even if the macro population started to bounce back immediately.
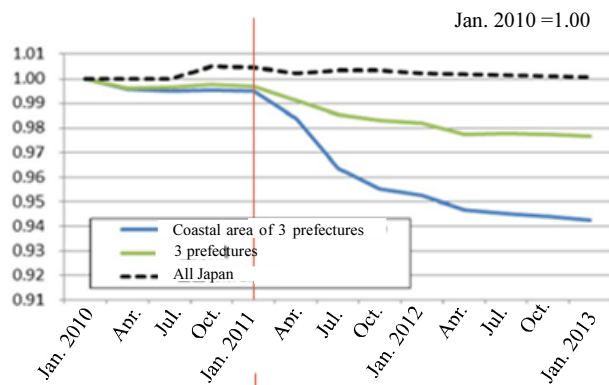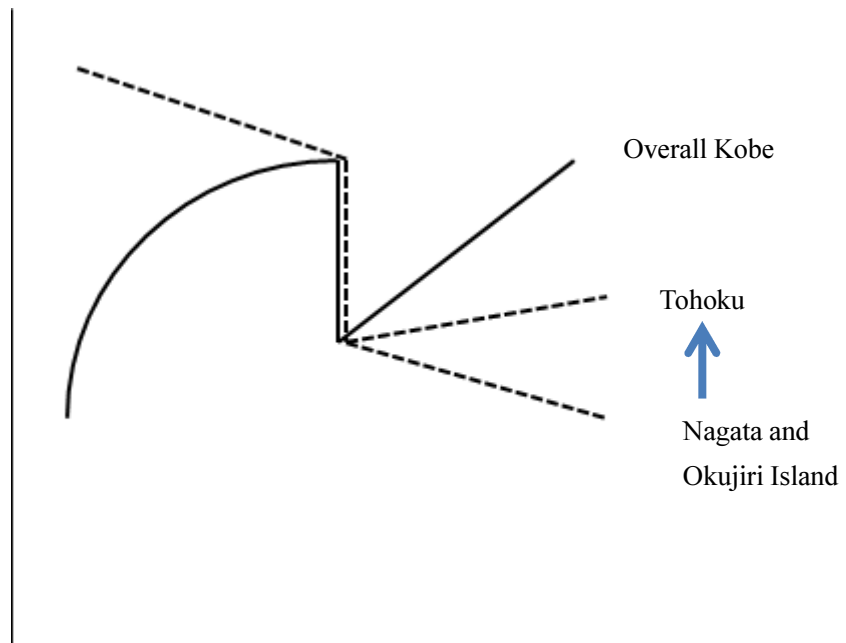
Figure 6-1: Index of population of Japan and Tohoku 3 prefectures (Iwate, Miyagi and Fukushima)
(Source: Reconstruction Agency 2013)
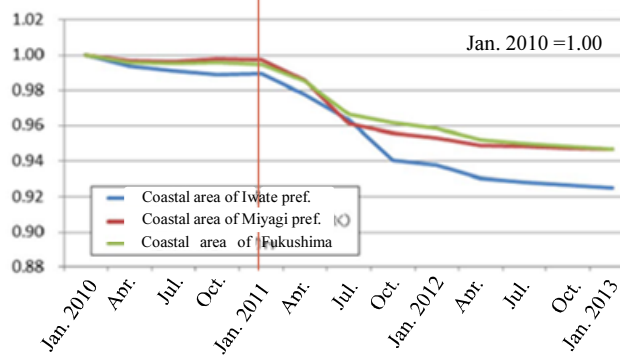
Figure 6-2: Index of population on coastal region of the 3 prefectures of Tohoku (Iwate, Miyagi and Fukushima)
(Source: Reconstruction Agency 2013)

Figure 6-3: Resilience framework
(Source: the author)

There is another similarity between Tohoku and Nagata. Both areas had struggled with population decline even before the disasters, as the population in the region is aging. The overall population of Kobe, however, was increasing at the time of disaster. The same trend can be found at Okujiri Island, which was hit by a tsunami in 1993; after twenty years the population had decreased by 40 percent. If we go back to the debate on resilience in Chapter 2, there is no way to go back to pre-disaster level since the trend was decreasing in Tohoku anyway. At least, we need to try to recover population as Figure 6-3 shows.

How can Tohoku be helped to bounce back again? As we discussed in resilience framework, recovery alone is not enough to bring this about. These areas need to face the chronic problems that existed even before the disaster, but which have been amplified by external shocks.

There is another similarity between Nagata and Okujiri. In both areas, huge infrastructural developments were implemented. In Nagata, an area that used to be inner city, which housed a cluster of shoe-producing industries, was redeveloped (fig. 6-4). During this process, many victims were evacuated to temporary housing. On the newly developed site, apartments are very popular and are sold out, but most of the residents are newcomers from outside of the community, and most of the pre-disaster residents have not come back. Therefore, the nature of the community has changed. As Ostrom (2000) stated, social capital (or common understanding) is easily destroyed when large numbers of people are rapidly displaced.[90] The redevelopment project in Nagata destroyed the social capital that existed before the disasters.[91]

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[90] Ostrom (2000: 179) stated that: 'Common understanding is easily eroded if large numbers of people are concerned or if a large proportion of participants change rapidly-unless substantial efforts are devoted to transmission of the common understandings, monitoring behavior in conformance with common understandings, and sanctioning behavior not in conformance with the common understanding.'

[91] Uphoff (2000: 223) also emphasized how easy it is to lose social capital: 'Societies and social relationships -quite like Rome- are not built in a day, though they can be destroyed almost that fast.' He also

Figure 6-4: Nagata redevelopment project

(Source: red circle was added by the author based on Homepage of the City of Kobe)
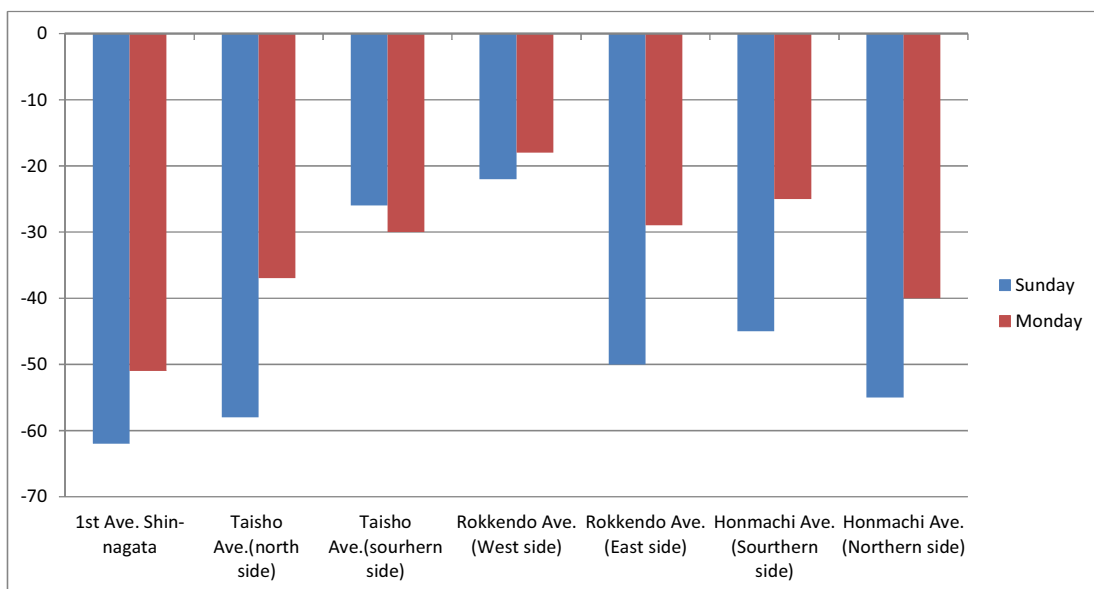
Figure 6-5: The volume of pedestrian traffic in 2006 compared with 1992 level

(Source: Edited by the author based on the City of Kobe 2008)

In the case of Okujiri, 76.4 billion Japanese yen of reconstruction investment was made against damage of 66.5 billion Japanese yen, constructing artificial levees to prevent tsunami damage. One of the common characteristics of the two cases is lack of linkage

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stated: '.... the building up of roles and norms need not be so slow as with soil, and networks can be established fairly quickly. Unfortunately however, social relationships and values-much like soil-can erode both faster and more easily than is true in the process of their formation.(p227)'

between social capital and infrastructural investment. Social capital is a pivotal driver to make markets work by promoting business startups and increasing employment. Infrastructure is important, but it should be considered as just one of many inputs into the production function. What is more important is to make investment plans for physical capital while taking social capital into consideration. This is in line with the policy recommendations of the World Development Report that "users and other stakeholders [should have] a strong voice and real responsibility" (World Bank 1994: 2).[92] To bring this about, social capital should be at the core of recovery and reconstruction planning, since it can shift the production function itself upwards.[93] Unlike physical capital, social capital does not wear out with use but rather is created with use (Ostrom 2000).[94] As Putnam (1993: 36) put it: "Social capital enhances the benefits of investment in physical and human capital." National and regional government institutions are critical to this because they are close to regional communities and individuals.[95] This is the only way to reconstruct Tohoku and encourage more people to come back, and it is relevant to potential future disasters not only in Japan but also all over the world.

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[92] This point has been discussed by various authors in the past such as Sengupta (1991) and Uphoff (1986).

[93] Ostrom (2000) discussed in detail based on a game theoretic analysis of an irrigation project of Nepal that without social capital, it is so difficult to manage physical infrastructure.

[94] Ostrom (2000: 180) stated that: 'Social capital may, in fact, improve with use so long as participants continue to keep prior commitments and maintain reciprocity and trust. Using social capital for an initial purpose creates mutual understandings and ways of relating that can frequently be used to accomplish entirely different joint activities at much lower start-up costs.'

[95] Ostrom (2000: 181) stated that: '.... social capital is harder than physical capital to construct through external interventions. A donor can provide the funds to hire contractors to build a road or line an irrigation canal. Building sufficient social capital, however, to make an infrastructure operate efficiently, requires knowledge of local practices that may differ radically from place to place. Organizational structures that facilitate the operation of physical capital in one setting may be counterproductive in another. Local knowledge is essential to building effective social capital.

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Figure 1   POSITIVE INTERACTION BETWEEN MACRO- AND MICROINSTITUTIONS
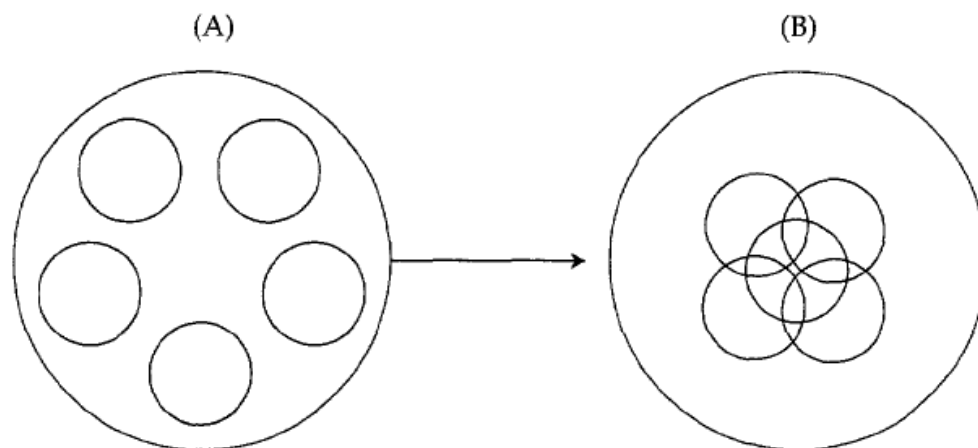
Source: Serageldin and Grootaert 2000:52

Figure 2   NEGATIVE INTERACTION BETWEEN MACRO- AND MICROINSTITUTIONS
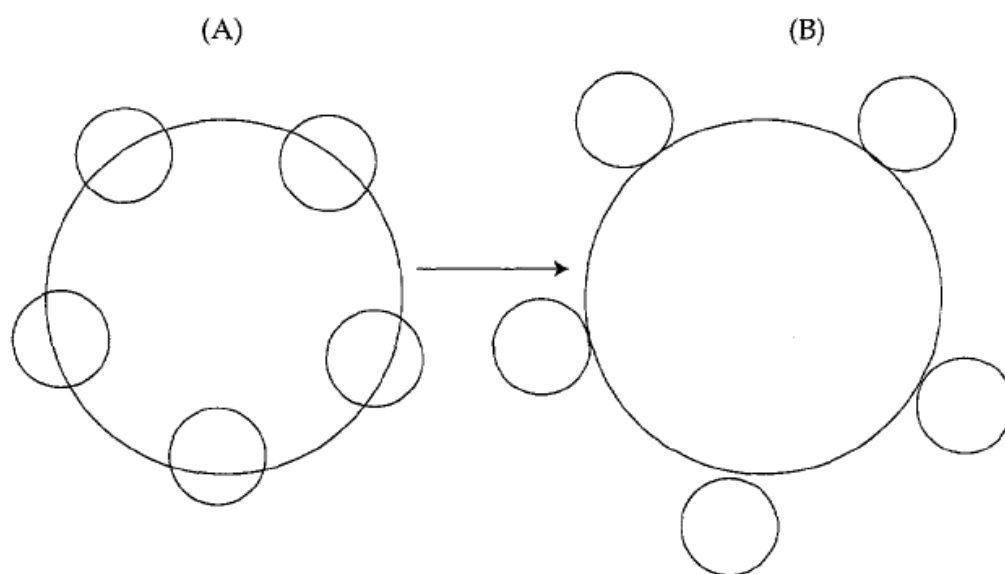
Source: Serageldin and Grootaert 2000:52

Figure 3   A CLASSIFICATORY SCHEME

Relational capital

	Strong	*Weak*
Strong	**(1)** *High social capital* Task: extend scope of activities	**(2)** *"Strong" organizations* Task: legitimation, intensification
Weak	**(3)** *"Traditional" associations* Task: introduce rules, procedures, and skills	**(4)** *Anomic, atomistic, or "amoral"* Task: assist development of structures and norms

Institutional capital

(Source: Krishna 2000:79)

Learning to Learn: A Case Study of Social Capital Strengthening in Ethiopia

1.   INTRODUCTION

Notwithstanding the much improved economic performance of Africa in the past decade or so; industrialization continues to languish. The percentage of the GDP held by the manufacturing sector has been declining since the 1980s. Recent economic growth is dominated by the mining sector. Foreign Direct Investment (FDI) also goes into natural resources and not the manufacturing sector. As the population grows, youth unemployment (in other words, job creation) will become a serious issue for sustainable growth as well as political stability in the region. Therefore, industrialization, which contributes to increase in employment and income, is crucial.

There has been heated debate over industrial policy elsewhere and a renewal of interest recently; it remains one of the most controversial topics (Noman et al., 2012; Lin, 2011; Lin and Chang, 2009; Cimoli, Dosi, and Stiglitz, 2009; Hausmann, Rodrik, and Velasco, 2005; The Economist, 2010).[96] This debate even goes back to 19th century economists Ricardo and List, and there is still little consensus.[97] From the viewpoint of the Washington Consensus, a number of issues such as rent seeking, political capture, policy mistakes, and picking the winner were raised (Krueger, 2011; Pack and Saggi, 2006). On the other hand, advocates of industrial policy have emphasized that   the market cannot be said to function perfectly to achieve general Pareto optimality under the assumption of perfect information and perfect competition, among other things (Greenwald and Stiglitz, 2012).

This paper will focus on the "learning" (or "learning how to learn") aspect of industrial policy. Knowledge gaps (not just resource gaps) have long been identified as issues requiring attention for development, but it has been long neglected (Stiglitz, 1998; Greenwald and Stiglitz, 2012; Noman and Stiglitz, 2012). Further, only a small number of papers have performed empirical analysis on learning in Africa in the past. Due to the recent growing interest in this field, the number of empirical studies has been growing gradually. These include the World Bank's report by Dinh et al. (2012) on light manufacturing in Africa, Eifert, Gelb, and Ramachandran (2008) on infrastructure and doing business, and de Mel, McKenzie and Woodruff (2008) and Banerjee and Duflo (2005) on financial market failures.

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[96] Following past literature such as Rodrik (2007) and Noman and Stiglitz (2012), this thesis also considers that industrial policy covers not only the manufacturing sector, but also broad sectors such as the agricultural and service sectors.

[97] Historically, the most successful countries including the US and UK, among other counties also proactively used industrial policy in its development process (Chang, 2002).

Regarding learning, it is important to disaggregate "what to learn." Technology and skill are not the only areas of importance for Africa. Industrial development does not occur by simply adopting new technology. There are other types of knowledge necessary to learn for industrialization, such as policy planning and managerial skills, as we will see later. Almost all the past literature on Africa, however, focused mainly on the technology/skill aspects. There is only limited literature surveying the policy and managerial aspects of learning in Africa, and still further empirical studies on other aspects of learning are required to see how effective learning is for economic growth (Sonobe and Otsuka, 2006; Sonobe, Suzuki and Otsuka, 2011; Klinger and Schündeln, 2007; Karlan and Valdivia, 2011; Field, Jayachandran, and Pande, 2010). This paper intends to shed lights on a comprehensive approach to learning, which will be discussed in detail later. For this purpose, this paper will look at the on-going project by JICA (Japan International Cooperation Agency) in Ethiopia.

2. LITERATURE REVIEW

2.1 Industrial Policy

In the 1990s, the major development policy was based largely on liberalization, privatization, and price-stability, and regarded the industrial policy as a source of inefficient, market distortion. In 1993, the OECF (Overseas Economic Cooperation Fund, now JICA) published Occasional Paper No.1 entitled "Issues Related to the World Bank's Approach to Structural Adjustment: Proposals from a Major Partner" (OECF, 1993a), arguing in favor of infant industry protection and of credit subsidies for selected industries believed to have export potential, which was in opposition to the Bank's approach. In the same year, the World Bank published "The East Asian Miracle," which gave very guarded and qualified support to industrial policy, and that too only for export promotion, not on import protection and credit market intervention. The OECF (1993b) disagreed with its view (Mosley et al., 1995). Although the World Bank published the report, the mainstream policy has not changed. Industrial policy was by and large sidelined.

In the wake of emerging economies such as China, India, Brazil, and South Korea, a growing number of people have started to regard industrial policy as an important policy tool for economic development as well as private sector development (Lin, 2012; The Economist, 2010; Hausmann, Rodrik, and Velasco, 2010; Lin and Chang, 2009; Cimoli, Dosi, and Stiglitz, 2009; Rodrik, 2007).[98] This trend is partly due to the response of developed economies after the Financial Crisis; Rodrik (2010) called this movement the "return of industrial policy." At least, if and how donors should promote industrial policy has become a hotly debated subject in recent years.

In the African context, in January 2008, the African Union Summit dedicated to the

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[98] Michael E. Porter (2007) proposed cluster approach and public policy to foster clusters instead of industrial policy because it minimizes distortions to competition, and is better aligned with market competition.

theme "the Industrialization of Africa," AU (African Union) (2008) adopted AIDA (Action for the accelerated Industrial Development of Africa), declaring that:

> "it is Africa's turn…. the time is now…. (n)o country or region in the world has achieved prosperity and a decent socio-economic life for its citizens without the development of a robust industrial sector." (p. 1)

The UN Economic Commission for Africa (UNECA) and AU published their annual Economic Report on Africa (ERA) in 2011. This report also concluded that the role of states needs to be enhanced to foster economic and social transformation, and to correct market imbalances.

Justin Lin (2012), the former Chief Economist of the Bank, proposed what he calls New Structural Economics (NSE). The concept of NSE is controversial because it differs from the traditional World Bank approach. In his classification, the NSE is the third wave of developmental thinking. The first wave was from the emerging and developing economies (old structural economics). They emphasized market failure and proposed import substitution for structural changes. The results were disappointing, and the second wave of thinking highlighted government failures, and emphasized "getting the prices right" policy. The third wave, which Lin proposed, intends to bring structural change back to the core of the discussion. His proposal is to industrialize according to the comparative advantages under the given endowment structure, which old structural economics went against. Regarding the last point on comparative advantage, Ha-Joon Chang is against comparative advantage theory, and argues that developing countries need to take more proactive industrial policy beyond the comparative advantage theory like Japan and South Korea (Lin and Chang, 2009).

Krueger (2011) commented on Lin's proposal that his view is industrial and urban biased (distortion), and there are many questions on the role of the state. Questions are, for instance, whether support should be given to all industries or to a specific industry, and what incentives (e.g., firm-specific treatment, subsidies, or tariffs?) should be included. She also pointed out the issues such as picking the winner and government failure as well.

On the other hand, Stiglitz (2011) agrees with the NSE proposal, and stressed, as Solow (1957) found, advances in technology have been the source of increase in per capita income over the last two centuries. In his view, disparity in knowledge matters for developing countries, so Stiglitz proposed to create "a learning society," in which society intends to absorb and adopt knowledge, and eventually to produce new knowledge. In addition to "learning," he also stressed the importance of "learning to learn (or the ability to learn)"[99] (Greenwald and Stiglitz, 2012; Stiglitz, 1987).

2.2 Learning

Regarding learning, investment in learning tends to become less than expected

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[99] Stiglitz (1989) explained the "learning to learn" effect by the following function: $lnC_t - lnC_{t+1} = a + blnQ_t$. Here, learning to learn changes the parameter b.

(underinvestment) due to market failure. This is because of imperfect information and the nature of knowledge, with characteristics of public goods associating with externalities (spillovers). Knowledge itself should be essentially zero marginal cost. In the real world, however, firms have a tendency of neglecting to take learning benefits into account, so the "learning phase" incurs losses for private firms. This becomes a barrier to entry, implying the existence of a monopoly (Stiglitz, 2010 and 2012). Unlike the aggregate growth model of a closed economy with competitiveness assumed by Arrow (1962) and Kaldor and Mirrlees (1962), Dasgupta and Stiglitz (1988) found that the assumption is not valid. In other words, market equilibrium is not efficient if firms learn with cost. Because of the market failure, the state has to play the role of a catalyst to learning.

Noman and Stiglitz (2012) discussed that development strategies need to focus on a LIT (Learning, Industrial, and Technology) policy. This is due to the effectiveness of the LIT policy in promoting technological changes and encouraging shifts in production structure, just as knowledge accumulation could change the endowment.[100] Further, it is argued that the LIT policy needs to support investment projects with large spillovers. The reason why the industrial sector is considered as important is that learning in the industrial sector has more spillovers to the rural/agricultural sector. Moreover, there is greater incentive to invest in R&D (innovation) in the industrial sector than in the rural/agricultural sector. In this regard, linkages between the natural resource extraction sector and other sectors were typically weaker than the manufacturing sector and the rest (Greenwald and Stiglitz, 2006 and 2012).

2.3   Managerial Capital

Then, the next question of "what to learn" comes to mind. Do we have to learn only "new technology," as Solow (1956) found?[101] When Lall, S. (1987) surveyed Indian firms, he stressed the importance of technological capability (TC). He disaggregates the TC into five elements: (1) project execution; (2); product engineering; (3) process engineering; (4) industrial engineering and planning; and (5) technological transfer. This classification is useful to deepen our understanding on elements of technology/skill.[102]

There is however, bias in his definition toward technical aspects of the firm. Other than these technological capabilities, private firms need to have other abilities as well: "management capabilities" which include marketing, finance, and external relations, among

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[100] They referred to examples from the US that the LIT policy led to the development of the telegraph, the Internet, and successful companies such as Federal Express.

[101] Ansu and Tan (2012) argued that even though skill development is indispensable for economic growth and employment, it costs too much for Sub-Saharan governments to finance. In other words, they need growth to finance skill development. To solve this chicken-and-egg problem, they proposed a two-way solution. First, in the short term, the strategy needs to focus on meeting industrial needs and spur growth. Second, in the long term, the strategy needs to improve the whole educational system. As for education, a number of studies found that higher education is closely correlated with firm growth in Africa (McPherson, 1996; Mead and Liedholm, 1998; Ramachandran and Shah, 1999; Mengistae, 2006).

[102] Cimoli, Dosi, and Stiglitz (2009) discussed that technological learning is mainly done by imitation, reverse engineering, and copying, for example. This kind of capacity is called "absorptive capabilities."

others (Wad, 1991).[103]

Although management capability is important, it has been neglected in development and growth literature. For Solow (1956), management capability is reduced to the residual of a production function (the error term).[104] In the early days, Lucas (1978) and Rosen (1982) proposed "talent for management" as an important factor for production. Few empirical studies however, have been conducted on the managerial capital in the theory literature. Bruhn, Karlan, and Schoar (2010) discussed that the capital missing in developing countries is "managerial capital." In their views, managerial capital can affect the production function through two channels. One is improving the marginal productivity of inputs (e.g., labor, physical capital). The other is improving resource constraints (e.g., access to capital or labor with better resource forecast).[105]

Recently, with the attention on this field growing, the number of empirical studies has been increasing. These include: Klinger and Schündeln (2007) on a business training program held in Central America; Karlan and Valdivia (2011) on basic business training in Peru; Field, Jayachandran, and Pande (2010) on financial and basic business training in India; and Bruhn, Karlan, and Schoar (2010a) on consultant services to supplement management knowledge. These studies found mixed pictures that some training improves business performance (e.g., revenue, profits, employment, productivity), but others may not.

Through an empirical study in Africa, Sonobe, Suzuki, and Otsuka (2011) also confirmed the importance of management capital, in that technical assistance on *kaizen* enables informal firms to expand operations and generate employment.[106] As we will see in detail in the case of Ethiopia later, a productivity and quality improvement method, called "*kaizen*," provides inexpensive basic management skills and can improve management practices. Their study focuses mainly business administration, basic business skill, and desk study of manufacturing floor management. They found that in Tanzania the training effects on record-keeping and *kaizen* practices are highly significant, and so affects marketing in Ethiopia. According to their study, a majority of entrepreneurs do not keep records of the costs and revenues, and it hampers their objective judgment on their operation.[107]

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[103] This thinking is the same as that of Cimoli, Dosi, and Stiglitz (2009) when they differentiate technological knowledge and sheer information. For them, technological knowledge is embodied in specific people, organizations, and local networks. They further classified production capacity and technological capabilities (or dynamic capabilities). The former is capacity to do routine work, and the latter is for technological change. It is argued that it is important for a country or organization to transition from production capacity to technological capabilities. Stiglitz (2012) also identified various structure of learning including these management capabilities as well, such as: inventory control process, labor management process, computerization, and financial service.

[104] Bruhn Karlan, and Schoar (2010a) incorporate management capital into endogenous growth theory, as A in the production function: $y = AK^{\alpha}l^{(1-\alpha)}$. This implies that A decides if other inputs lead into high level of outputs.

[105] Recent papers also found that management practices and education are of low quality in developing countries, such as Chaudhry (2003) and Bloom and Van Reenen (2010).

[106] Similarly, Cimoli, Dosi, and Stiglitz (2009) also emphasized "problem solving knowledge" embodied in organizations (such as production technologies, marketing, labor relations, as well as "dynamic capabilities" of learning).

[107] Sonobe and Otsuka (2006) studied eight industrial clusters in Japan, China, and Taiwan, and found that multi-faceted innovations are needed to achieve a major improvement in the enterprise performance. Further,

2.4 Policy Learning

In addition to the managerial capital, there is another important element of learning. That is policy learning. When Lall (1987) surveyed Indian firms, he rightly concerned the methods by which individual firms acquired technological capability (TC). These firms considered policy environment as an external factor, and they had got TC without any support from the government. As we have already seen, because of market imperfection, the knowledge does not spillover automatically. It is important for governments in developing countries to promote knowledge spillover, and to encourage learning.

There have been successful policies and failures in the past. Looking at the development cases of Asia, their recipe and timing (what and when) varies country by county (JICA, 2008). In other words, country context mattered greatly when planning industrial policy. As country context matters, a government should not just blindly copy the successful policy of another country: they need to learn how to analyze country context and how to adopt the best possible scenario. In other words, they need to "learn how to learn" selectively from the cases of various countries. For instance, the role of public sector to develop SME (Small and Medium Enterprises) changes according to the country context and to the stages of industrial development. Ito and Urata (1998) compared the development of the auto parts industry in Japan and Korea, and found different roles for the public sector to promote the auto industry. In Korea, the public sector was to dissipate knowledge to SME, but in Japan, the public sector played a small role. Ohno (2013) stressed the importance of policy learning, and discussed that policy learning should be based on a systematic collection and comparison of international best policy practices and failures. This is to enhance government capability for a country to be able to become industrialized. Thus, policy learning is another aspect on which some thought is required.

Regarding learning on a policy level, there are several attempts from donor countries. One example is the KSP (Knowledge Sharing Program) of the KDI (Korean Development Institute). The case we will see in this paper is JICA's program in Ethiopia. One feature distinguishing this program is a comprehensive approach, which we will discuss in the next section.

3. POLICY AND MANAGEMENT CAPITAL LEARNING IN ETHIOPIA

3.1 A comprehensive Approach to Learning

As we have seen so far, two levels of learning are necessary: (1) policy level (policy learning) and (2) private firm level (technology/skill and management capital learning). The two of them are inseparable. Business environment affects private firms' strategy in the market.

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they argued that the innovations are difficult tasks, and it is possible only by entrepreneurs with higher education or entrepreneurs with rich managerial human capital.

There are various elements in the business environment which private firms need to take into consideration. Among them, the following elements are especially important: outlook on inflation and exchange rate, changes in the system of taxation, and industrial policy.

Here, industrial policy, in broad definition, includes various policies. These are: infrastructure development policy, education and vocational training policy, financial policy (especially loans to small and medium-sized enterprise), FDI promotion policy, trade policy, intellectual property rights policy, industrial standards policy, among others. The outlook of these policies will affect a private firm's long-term strategy especially for its investments, but not its short-term strategy. If the future is uncertain, it will result in low investment in the private sector since private firms would not take the risks. The term "investment" includes investment on productivity and quality improvement as well as physical investment.

A government policy will affect private firm's decision in many ways. For instance, productivity and quality improvement will be discouraged under high inflation and exchange rate volatility. This is because it is difficult for private firms to recognize and measure the results of the improvements under uncertain situations. On the other hand, government support such as infrastructure development, education, vocational training, and SME development policy will encourage private firms to improve productivity. Thus, policy and private firms' operations are closely connected to each other. In order to industrialize, it is necessary to tackle both policy and private levels.

Figure 1: Structure of Learning

1. Policy Level
1-1 Policy Planning
1-3 Policy Implementation
2. Private Firm Level
2-1 Strategic Business Administration
2-2 Manufacturing Floor Management
2-3 Basic Business Skill
2-3 Technology/Skill

Now, each level can be disaggregated. Regarding the policy level, these are (1-1) policy planning and (1-2) policy implementation. The capacity of policy planning is important, as the previous section discussed. The capacity for policy implementation is different from that of policy planning. How effective a government can implement a policy largely depends on their organizational capacity. Industrialization is a multi-sector (or a multi-ministerial) task. Several sectors can be involved in exporting even a single agro-industrial product abroad: for example, agriculture, manufacturing, and transport sectors. In addition, factors such as quarantine, tax and customs procedures, and exchange rate are also affects export performance. In other words, to promote exports, it requires total governmental effort with

inter-governmental coordination as well as public-private consultation. The coordination with all stakeholders requires very high capacity, and is a difficult task.

In some countries, excellent policy plans are drafted, without taking feasibility and government organizations' capacity into account. These two factors are correlated, but the issues that need to be learned are different. As Cimoli, Dosi, and Stiglitz (2009) discussed, "organization building" is one of the most difficult tasks, and policies and institution-building have shaped both the accumulation of technological and organizational capabilities. These capabilities decide the national capabilities to catch up with crucial knowledge (Cimoli et al., 2009). This paper disaggregates these.

Turning now to the private firm level, there are four sub-levels of entrepreneurial skills: (2-1) strategic business administration (including labor management and computerization); (2-2) manufacturing floor management (including inventory control); (2-3) basic business skill; and (2-4) technology/skill. Basically the first three items are elements of managerial capacity. The capacity of strategic business administration (2-1) is required for employers and the business administration department. Manufacturing floor management (2-2) is required for factory workers as well as factory managers. The basic business skill (2-3) was found lacking by Sonobe, Suzuki, and Otsuka (2011) in many micro and small enterprises in Africa. This includes skills such as record keeping, which is essential for the day-to-day operation of a company in any general affairs. This paper will look at the case of Ethiopia based on this structure.

3.2   Background of the Program in Ethiopia

As a comprehensive approach to learning, this paper will take up a program in Ethiopia supported by JICA in collaboration with GRIPS (National Graduate Institute for Policy Studies of Japan). This program was initiated in response to the request from the late Prime Minister Meles, and has two components: support to formulate industrial policy in the new five-year development plan (industrial policy dialogue); and support to develop private firms (a project for quality and productivity improvement). These two components are implemented side by side, taking the linkage between the policy and operation of private firms into consideration. This program started in 2009 and completed its first phase in 2011. The program was started with strong leadership by high-ranking government officials (top-down), and was implemented by equally strong ownership by government technocrats and private firms (bottom-up).

The late Prime Minister was critical of the Solow model because the model treats technological change as something external to the economic process, as an exogenous factor (Zenawi, 2012). In his view, technology is a public good, and there are market failures in providing it. Therefore, he believed that developing countries should not leave technological development (innovation) to the market, and the key to this is learning from abroad. So, he argued that technological capability accumulation is the central challenge for developing countries to achieve continued growth. It will enable developing countries to move up the

technological ladder. He compared two types of national innovation systems, and discussed that the system needs to reflect the structure of the economy. Those systems are: mission-oriented systems in the US, UK, and France and the diffusion-oriented systems of Germany, Sweden, and Switzerland. A mission-oriented system is a system to explore the new technology, such as by first-rank universities. A diffusion-oriented system is to exploit existing technologies through social mechanisms such as standardization of products, or an apprentice system of training craftsmen. For developing countries, he discussed that it would be easier to adopt and adapt existing technology in developed countries rather than innovation.

　　　　With this view, he tried to learn from cases in foreign countries such as South Korea and Taiwan. He even sent government officials to these countries. In addition, he requested specific assistance to adopt and adapt existing technology from development partners such as Germany, Italy, and UNIDO (United Nations Industrial Develop Organization) (Ohno, 2013). In response, Germany implemented ECBP (Engineering Capacity Building Program). ECBP includes a TVET (technical and vocational education and training) system, engineering and private sector development, among others. From Japan, he requested the specific support mentioned above.

3.3　Outline of the Program

3.3.1　Industrial Policy Dialogue – Mutual Learning

The industrial policy dialogue was started in June 2009 and ended the first phase in May 2011. The dialogue was started together with the pilot project for productivity and quality improvement (*kaizen*), which we will see in the next section. The aim of the dialogue is to exchange views on: (1) the new five-year development plan;[108] (2) issues needed to be tackled for policy planning and implementation (e.g., inter-governmental coordination); and (3) progress and issues on the pilot project. These three elements complement each other, and cover policy strategy to private sector operation on the ground.[109]

　　　　The dialogue was held quarterly eight times at three levels: (1) Prime Minister, (2) Ministers and State Ministers, and (3) Heads of Directorates and Institutes. These three levels have different organizational responsibilities and authorities on policy planning and policy implementation. Therefore, naturally, even if the topic is the same, the contents of discussion and issues to be challenged are different. From the Japanese side, the core members of

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[108] The five-year plan (2005-2009) is the Plan for Accelerated and Sustained Development to End Poverty (PASDEP). The debate was also held for the new five-year plan namely, the Growth and Transformation Plan (GTP, 2010-2015).

[109] This dialogue was an approach to "mutual learning" between the Ethiopian side and the Japanese side. As discussed, context matters greatly for policy planning; the Japan side has rich knowledge on East Asian cases, but little knowledge on the Ethiopian economy. The Ethiopian side understands its own economy, but has little knowledge regarding East Asian cases. If policy prescription were one-size-fits-all, things would be much simpler. The dialogue approach provided mutual learning opportunity to find solutions.

JICA-GRIPS team were Prof. Kenichi and Izumi Ohno.

3.3.2   The Pilot Project for Productivity and Quality Improvement (kaizen)

In parallel with the policy dialogue, a pilot project for productivity and quality improvement started in October 2009 and ended in May 2011 (phase 1). Phase 2 of the project has been underway since November 2011. The productivity and quality improvement is called "*kaizen*." It is a method to continuously improve productivity and quality in a participatory process and a bottom-up approach. Under the structure of learning we discussed above, *kaizen* mainly focuses on (2-1) strategic business administration, and (2-2) manufacturing floor management. It does not require additional cost from the employer. It does not require restructuring such as cutting employment, unlike BPR (Business Process Reengineering).

Japan itself introduced productivity and quality improvement in 1955 at the start of Japan's era of rapid economic growth, learning from American business management tools.[110] There were dual aims. One was to enhance competitiveness to expand the market, utilizing resources effectively and scientifically, at the same time reducing production costs. The other was to boost employment and to enhance real wages and the standard of living.

3.4   Impacts and their Causes

What kind of impact did the program have? Before examining overall impacts, we will start by looking at the impacts of the pilot project. There is a certain degree of limitation in this analysis due to lack of data such as bench marking data since the program was not designed to be analyzed by econometric analysis such as RCT (Randomized Control Trial). Therefore, the analysis here is only a qualitative analysis. It is a future task after phase 2 to run a more rigorous impact analysis.

Regarding the pilot project, a team of JICA and Ethiopian experts together visited 28 pilot private manufacturing firms 10 times each, and gave them questions, rather than answers, on what the companies needed to think about to improve their operations. The 28 pilot private firms were from the (1) agro-processing, (2) chemical, (3) metal, (4) leather, and (5) textile industries. After the 10 consultations over a half-year, as Figure 2 shows, the highest benefit to a company was 3.25 million Ethiopian Birr (ETB), equivalent to around USD 195,195. The 28 firms had obtained an average benefit of ETB 500,000 (equivalent to around USD 30,030). Given that the average number of employees was 402 per company, the pilot project generated a benefit of ETB 1,240 (USD 74.5) per head, which almost equaled the prevailing gross monthly wage (USD 75).

These improvements, having such significant impacts, were made without additional investment cost. The firms simply improved their method of operations through *kaizen* by

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[110] The three guiding principles of productivity improvement were set out in 1955 in Japan, which were: (1) expansion of employment; (2) cooperation between labor and management; and (3) fair distribution of the fruits of productivity.

conducting 5S activities and reducing seven types of waste (overproduction, inventory, repairs/rejection, motion, processing, waiting, and transport).[111]

Figure 2: Results Observed from the Pilot Project Companies (examples)

Quantitative Results (Monetary Impacts)
(1) **Average quantitative benefit of ETB 500,000 (USD 30,030) per pilot company.** Given that the average number of employees is 402 per company, the average benefit per head is ETB 1,240 (USD 74.5), which is comparable to the prevailing gross monthly wage (USD 75).
(2) **Company A reduced costs by (a) ETB 10,000 (USD 600) per month and (b) ETB 78,000 (USD 4,685) per annum.**
(3) **Company B generated additional income of ETB 1.2 Million (USD 78,072) per year.**
(4) **Company C decreased down time ETB 204,000 per day (USD 12,252).**
(5) **Company D rectified raw material defect used for manufacturing ETB 2.4 million (USD 144,144).**
(6) **Company E identified repaired and reused usable machines and equipment worth 3.25 million USD.**
Quantitative Results (Non-monetary Impacts)
(1) **Company F increased labor productivity, by reducing time loss for searching for tools on average by 50%.**
(2) **Company G reduced floor space by around 50%.**
(3) **Company H improved the defect ratio in the range of 50 to 70%.**
(4) **Company I improved lead time in the range of 16 to 90%.**
Qualitative Results
(1) **Clean working environments created.**
(2) **Teamwork and motivation of workers developed.**
(3) **Health and occupational safety of workers improved.**
(4) **Increased employee participation.**
(5) **Knowledge obtained on how to meet quick delivery and to reduce costs.**

Source: the author based on Shimada, Homma, and Murakami, 2013 and JICA, 2011b
Note: 1 ETB = USD 16.65

Figure 3 shows qualitatively measured results by the Ethiopia-JICA team. Companies classified as grade 5 means that there is a high possibility to be a model company, with the other grades meaning: Grade 4 (good possibility); Grade 3 (some possibility); Grade 2 (low possibility); and Grade 1 (no possibility). In short, this figure shows 10 companies out of 28 companies (more than one-third) are graded 5 and 4 as candidates for being excellent companies in the near future. These results indicate that even if the input is small, learning about (2-1) strategic business administration and (2-2) manufacturing floor management have

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[111] 5S is the working environment improvement methodology called *Seiri* (orderliness), *Seiton* (tidiness), *Seiketsu* (cleanliness), *Seisou* (cleaning up), and *Shitsuke* (discipline); these terms have been standardized in English as Sort, Set in Order, Shine, Standardize, and Sustain.

certain positive impacts. In other words, according to the 28 pilot companies experiment, there are huge possibilities for Ethiopian (or African) enterprises to improve productivity and quality greatly with small changes in (2-1) strategic business administration and (2-2) manufacturing floor management.

Figure 3: Qualitatively Measured Results from the Pilot Companies

Sub-sector	Grade					Total No. of Companies
	5	4	3	2	1	
Metal	1	2	2	2	1	8
Textile	1	1	1	1	1	5
Agro-processing	1	1	1	2	1	6
Chemical	3		2	1	3	6
Leather			2			3
Total Occurrences	6	4	8	6	6	28

Source: JICA, 2011a

3.4.1 Factors of Different Pace of Progress: Clear Policy Message from the Government and Manager's Strong Commitment and Ownership

Then, is learning about (2-1) strategic business administration and (2-2) manufacturing floor management enough to improve private sector operation without any learning on the policy level? What are the decisive factors for success and failures among pilot companies? The pace of progress is different among companies participating in the *kaizen* project.

One of the important factors of success was the managers' strong commitment and ownership to introduce the new method. Managers of successful companies understood that the key to improve productivity and quality is a bottom-up approach at the manufacturing floor. They tried to build good management-employee relationships, appreciating communication with employees and employee training. This commitment of managers is difficult to measure. Before the project, *kaizen* was new to Ethiopia, and managers did not have knowledge about the method. Considering the situation, it was extraordinary that Ethiopian entrepreneurs showed strong commitment to the new method. What was the reason behind it?

It was the clear policy message from the government that the government will support the introduction of the new method. The late Prime Minister and other government high-ranking officials had mentioned the initiative to introduce *kaizen* on TV and in public speeches. This clear message reduced the entry barrier for private companies to learn the method and improve productivity and quality. Unlike under the condition of asymmetry of information, managers took the learning benefit into account, so the learning phase was not considered a loss for them. Because of this clear policy message, an introduction seminar on

kaizen held before the project started, in Addis Ababa, attracted huge attention. Even though *kaizen* was very new to Ethiopian entrepreneurs, more than 320 entrepreneurs from 170 private companies attended the seminar. The policy message generated commitment and ownership of Ethiopian entrepreneurs.

3.4.2 Learning Policy Planning: Focus on Quality and Productivity

In spite of the clear massage from high-ranking officials, the same policy massage was not clear in the policy documents such as the five-year development policy and sectorial development policy. In the process of the preparation of the GTP, the policy message was discussed in the policy dialogue. The issue was how to synchronize the GTP, a guiding framework of national development plans, and activities on the ground. For that purpose, MSE (Micro-Small Enterprises) policy was discussed in detail.

The Ethiopian government examined Asian cases by themselves with JICA-GRIPS providing some comparative case studies from East Asia such as Japan's SME development policy and Singapore's nation-wide movement of productivity and quality improvement. This self-learning increased policy space, and a result of this, in the framework of the GTP, a new MSE development strategy was adopted, referring the introduction of *kaizen* to industrial development. This policy shows the policy direction, and catalyzes learning in the private sector.

3.4.3 Learning Policy Implementation – Coordination and Capacity Development

Another important point is policy implementation by government bureaucrats and technocrats. One of the issues raised and discussed in the policy dialogue was a policy coordination mechanism across ministries and agencies. For industrialization, as we saw, different ministries and agencies are involved. For any government, it is a challenge to build consensus on key policy directions and the way it is implemented among stakeholders inside and outside government. East Asian countries have certain mechanisms to coordinate this. JICA-GRIPS provided the Ethiopian government with various case studies of such mechanisms.

In terms of MSE development in Ethiopia, there are several ministries and agencies in charge of it, and the government setup is very complex. These include the Ministry of Industry (MoI), Ministry of Urban Development and Construction (MoUDC), Ministry of Education (MoE), TVET, and the EKI (Ethiopian *Kaizen* Institution). Learning the coordination mechanisms of East Asia, the Ethiopian government also developed several coordination mechanisms. For example, for MSE development, a National Council was established to coordinate it, co-chaired by MoUDC and MoI. This coordination mechanism reduces unnecessary fragmentation.

Further, regarding learning *kaizen* at the private firm level, the government agency plays an important role in catalyzing the learning. The important thing is that the above impacts of the project were brought from the Ethiopian government experts who learned the

method based mainly on on-the-job training (spillover effects based on the knowledge acquired by doing).

The experts belonged to the *Kaizen* Unit in the then Ministry of Trade and Industry (now the Ministry of Industry). The late Prime Minister established this new unit just before the start of the pilot project, as a part of his initiative. The member of Unit consists of nine young Ethiopian professionals, but without any knowledge about the method. There was very clear policy guidance for them from the Government high-ranking officials and the new MSE development policy. They also received higher demand from private firms other than the pilot companies (bottom-up needs), as they knew that the government supported the introduction of *kaizen*. These demands from the top and from the ground are the driving force behind their self-learning.

3.4.4   Policy Learning and Expanding Policy Scope

The business environment for pilot companies was an important factor. The successful companies had no disruptive management condition. On the other hand, companies with disruptive management conditions failed to progress. The condition was mainly being unable to procure essential materials for their operations due to the shortage of foreign currency. Ethiopia had difficulty with importing some essential materials.

The issue of shortage of foreign currency had been discussed at the policy dialogue, and pros and cons of import substitution policy discussed in the process to prepare the GTP. With careful examination, the government of Ethiopia expanded the scope of the policy from an export promotion policy focusing on a few selected sectors (such as leather and leather products, textile and garment, and agro-products) to an import substitution policy. The import substitution policy focuses on industries such as chemical, metal and engineering. Regarding the expansion of policy scope, Dani Rodrik of Harvard University also advised the Ethiopian government in 2008 (Rodrik, 2008; Ohno, 2013).

As Figure 4 shows, although this management skill was new to the Ethiopian experts before the project, after the project six out of nine experts were assessed as being competent enough to be a Consultant and provide a consultancy service, and three experts were assessed as assigned to be Assistant Consultants.[112]

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[112] In response to the achievements of the initial project, which ended in June 2011, including the *kaizen* dissemination plan, in October 2011 the Ethiopian Government established the world's first governmental institute named *kaizen*, called the Ethiopian *Kaizen* Institute (EKI), under the Ministry of Industry. The Ethiopian Government and JICA began the Phase 2 *Kaizen* Project in November 2011 for capacity building of EKI and related organizations in order to disseminate *kaizen* throughout the country. This project is expected to contribute to establishing a system to disseminate *kaizen* in Ethiopia in a sustainable manner.

Figure 4: Assessment of Capacity Development of Ethiopian Experts on *kaizen*

Level	Competence	Level of knowledge and skill	Assignment	Before the Project	After the Project
5	Competent to provide consultancy services on *kaizen*	- 8 years of experience and more - Experience of consultancy services for at least 30 companies by him/herself in 6-years service	Lead Consultant		
4	Competent to provide consultancy services *kaizen*	- 6 years experience - Experience of consultancy services for at least 15 companies by him/herself in 4-years service	Senior Consultant		
3	Competent to provide consultancy services on *kaizen*	- 4 years experience - Acquired relevant knowledge and skills for *kaizen* in addition to TQM/QCC/5S/QC 7 tools - Acquired other knowledge and skill on industrial business engineering (financial management, human resource management etc.) - Competent to prepare case materials for training exercise - Experience of consultancy services for at least 5 companies by him/herself in 2-years service	Consultant		6
2	Competent to guide *kaizen* activities	- 2 years experience - Acquired advanced and applied knowledge and skills on TQM/QCC/5S/QC 7 tools - Competent to present at least 5 case studies of *kaizen* for training purpose	Assistant Consultant		3
1	Competent to conduct *kaizen* activities for yourself	- Acquired person with no experience - Acquired basic knowledge and skill on TQM/QCC/5S/QC 7 tools - Competent to make at least two cases analysis	Junior Consultant		
0	No experience			9	

Source: JICA, 2011a

Note: TQM: Total Quality Management; QCC: Quality Control Circle; 5S: Sort, Set in Order, Shine, Standardize, and Sustain; QC: Quality Control.

As we have seen with the Ethiopian case, learning managerial knowledge improved performance of private firms. The quality and productivity project focuses, among various aspects of managerial capital, on strategic business administration and manufacturing floor management. Policy learning also contributed to the improvement, expanding the policy scope of the government to help private sector development. Selective policy learning from successes and failures of East Asian countries enables the Ethiopian Government to expand the policy scope of the Ethiopian government. The clear policy direction catalyzed learning on the ground. The coordination mechanism among Ministries and government agencies made the approach to MSE development more comprehensive rather than fragmented. The government agency has got practical knowledge on *kaizen* through learning by doing, and has disseminated its knowledge to private sectors to improve their productivity and quality.

4.   CONCLUSIONS

This paper examined the learning aspect of industrial policy, disaggregating the elements of learning, which mainly consist of policy level and private company level learning. Earlier literature focused mainly on introducing skills and technology into private companies. Recently, there is growing interest in managerial capability learning. This paper explored the possibilities of a comprehensive approach since policy learning and managerial capability learning are inseparable, and used a case in Ethiopia to study the impacts.

The results of the Ethiopian case imply that learning on various levels will strengthen Africa's private sector for industrialization allowing it to become competitive . This comprehensive approach of learning is still new to the development partners. The approach will enable African countries to sustain their economic growth, diversifying their economies and securing more jobs for the younger generations.

As mentioned, there is certain limitation set on this case study due to lack of data. The ongoing empirical study for the phase 2 should provide and a more thorough analysis.

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