Chapter 8
A Quantitative Study of Social Capital in the Tertiary Sector of Kobe: Has Social Capital Promoted Economic Reconstruction Since the Great Hanshin Awaji Earthquake?

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1. 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. A total of 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 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 the process? The objective of this paper is to revisit the experience of the Great Hanshin Awaji Earthquake.

1. Eighteen years after the disaster: has kobe recovered and reconstructed?

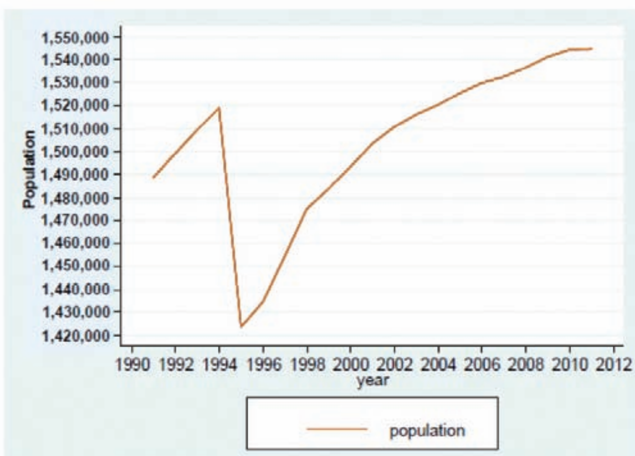
Has Kobe fully recovered from the earthquake 18 years ago? This is a question difficult to answer in one word. Let us look at Kobe from the viewpoint of the resilience framework presented in the last chapter (Norman 1971; Anthony 1987; Okada 2005; Norris et al. 2008; Longstaff et al. 2010; Guillaumont 2009).

As indices for recovery and reconstruction, this paper focuses on population growth and employment because these are the most important factors of recovery and reconstruction, respectively. 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' houses; 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 decreases. 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 the 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 paper will focus on the reconstruction phase, we will focus on employment in Kobe.

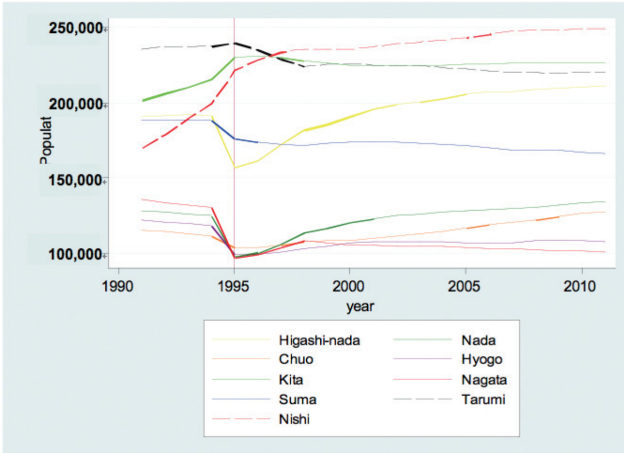
The population of Kobe declined drastically the year the disaster occurred. Compared with the previous year, the population declined by around 95,000 inhabitants. In this figure were the 6,434 people killed in the earthquake; the rest, around 85,000, moved out from Kobe. As the years went by, the population gradually returned. In 2004, almost a decade after the earthquake, the population of Kobe recovered to its pre-disaster level (fig. 2). However, ward by ward data shows a different picture (fig. 3). As the map of Kobe shows there are nine wards in Kobe (fig. 1 on p. 159). Among the nine wards, the eastern parts of the coastal wards were severely damaged (Higashi-nada, Nada, Chuo, Hyogo, and Nagata), while the western parts of the coastal wards and mountainous wards were relatively less affected (Suma, Tarumi Nishi and Kita). There is a stark difference in the death toll ratio between the two groups (Table 1). What are the factors contributing to this difference among the wards of Kobe?

Figure 2. Population of Kobe



(Made by this author based on statistics of the city of Kobe (2013))

Figure 3: Population of Kobe by Ward



(Made by this author based on statistics of the city of Kobe (2013))

Table 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

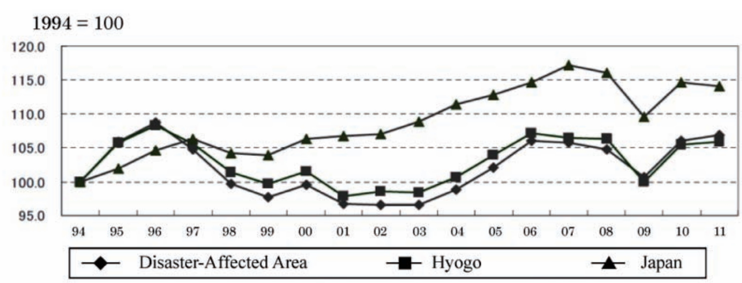
(Made by this author based on statistics of the city of Kobe (2013))

So, does the magnitude of damage affect population growth trends after the disaster? As Figure 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 continued 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, the 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 ward if Kobe has recovered or not because of this mixed picture.

So, how was economic recovery of Kobe? Figure 4 shows that after the earthquake its economy quickly improved 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.[1] 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.[2]

Figure 4. Time-series data on gross output



Source: Hyogo 2013

Figures 5 and 6 show the share of the working population in secondary and tertiary sectors, respectively. It is very clear that after the disaster,

1. 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.

2. Beniya, Hokugo and Murosaki (2007) analyzed local industries such as the artificial leather shoes industry cluster, and concluded that the industry of Kobe had not yet fully recovered.

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 a 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. Percentage of the working population in secondary industries

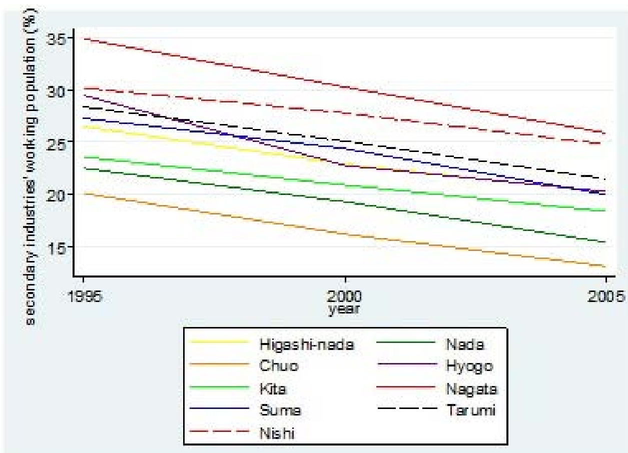
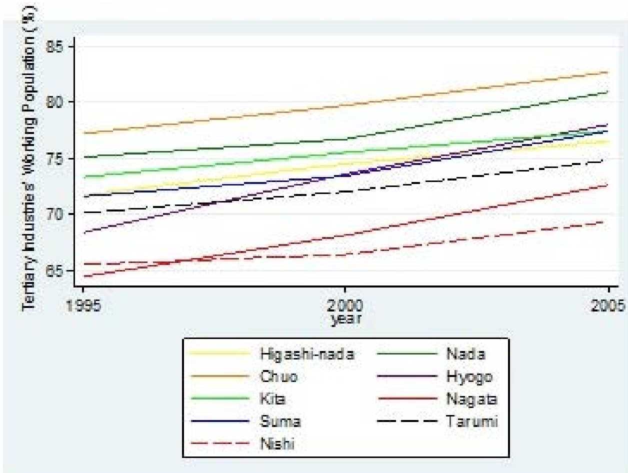


Figure 6. Percentage of the working population in tertiary industries

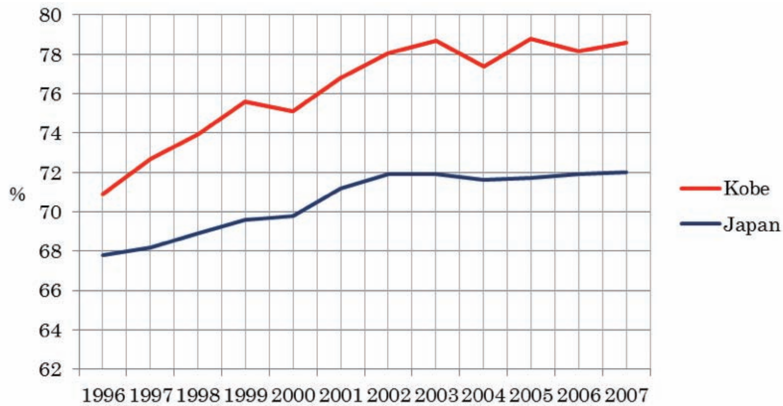


On the other hand, the tertiary sector recovered well and in most wards the number of people working in this sector has increased beyond pre-disaster levels. According to the statistics of the city of Kobe (2006 and 2009), the medical and welfare industries, and education support and service sectors have grown rapidly both in the number of offices and employment.[3] In terms of employment, the tertiary industry accounted for 83.5% of total employment in 2006.[4] 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 figure for Japan (fig. 7). As the figure shows, the tertiary industry of Kobe has expanded rapidly since 1996, moving from 70.8% to 78% in 2009 compared with the rate of expansion for Japan overall. 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.

3. The number of those employed in the manufacturing industry declined.
4. It is 0.1% and 16.4% for the primary industry and secondary industry, respectively.

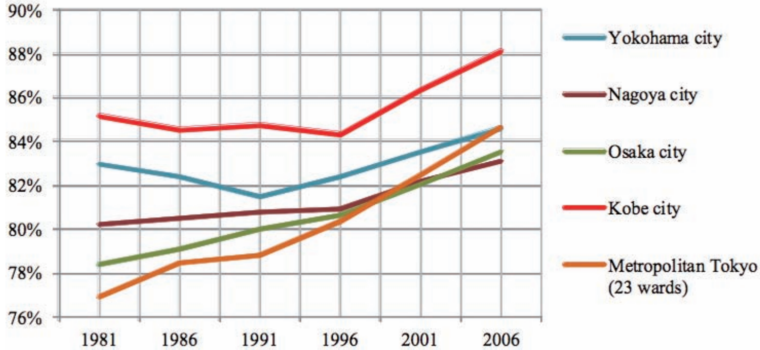
Figure 7. Industrial structure of Kobe



(By this author based on the database of the city of Kobe 2013)

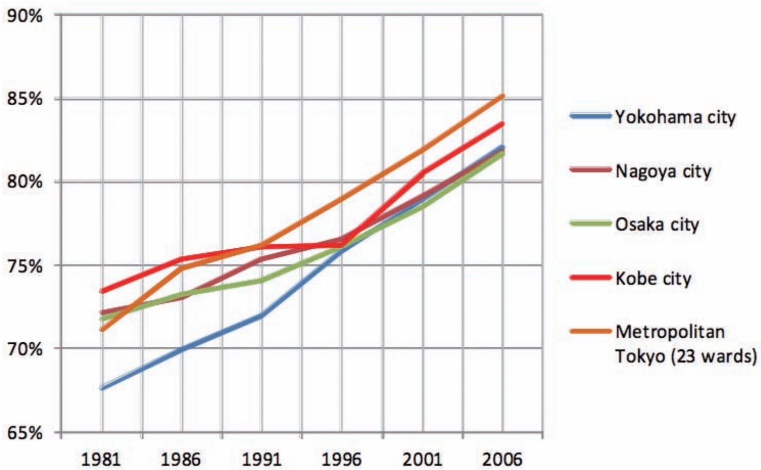
Now, let us look at the third tertiary sector of Kobe in comparison with other major urban cities of Japan. Figure 8 shows the ratio of tertiary sector offices among all industries. The ratio of Kobe has been high compared with other major cities, but the ratio was declined slightly before the earthquake. This trend suddenly changed after the earthquake, rapidly turning to an upward trend. The same is true for the ratio of employees working in the tertiary sector (fig. 9). 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 the 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 the tertiary sector was the driver of economic recovery.

Figure 8. Ratio of tertiary sector offices



(By this author based on the database of the government of Japan 2013b)

Figure 9. Ratio of tertiary sector employees



(By this author based on the database of the government of Japan 2013b)

One of the reasons for the development of the tertiary sector is the Kobe Bio-medical Innovation Cluster (KBIC) in 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 businesses 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 (which utilizes vacant stores for glassware sales as well as town planning consultation), and Hyogo Transfer Service Network (which 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 of economic reconstruction, providing jobs through multiplier effects.

As we have seen, 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 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 paper focuses on the tertiary sector. How does social capital play a role in promoting the sector?

2. Literature review

There is a vast amount of 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 Awaji Earthquake discourse was the emphasis on social capital. The city of Kobe formed the Social Capital Study Group in 2006, inviting social scientists as advisors, and 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 a residential area and an artificial leather shoes industrial cluster, and the northern part of Noda in Kobe's Nagata Ward. The report found that the community was a catalyst between the city administration and residents, which is critical in the process of recovery. Further, it concluded that the community functioned well even before the earthquake, and 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. Tatsuki (2005, 2007) 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 a community with social capital records the highest satisfaction rate for new town planning and has the speediest recovery rate. 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 reconstruction phase. Social capital is considered to promote the start of business (Nam, Sonobe, and Otsuka 2010; Todo, et al. 2013).[5] There are four causal relations (Table 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.

5. 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; however, 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.

Table 2. Social capital in post-disaster application (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: by this author)

In the four causal relationships, two common factors are crucial. One is to decrease asymmetry of information. Under this condition, it is known that the market fails and investment becomes less than the desirable level (underinvestment) (Dasgupta and Stiglitz, 1988; Stiglitz 2010 and 2012). Social capital complements this market failure. As an entrepreneur gets more information from a social network, it decreases the asymmetry of information, and, therefore, promotes investment.

Asymmetry of information is common in labor markets as well. 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.

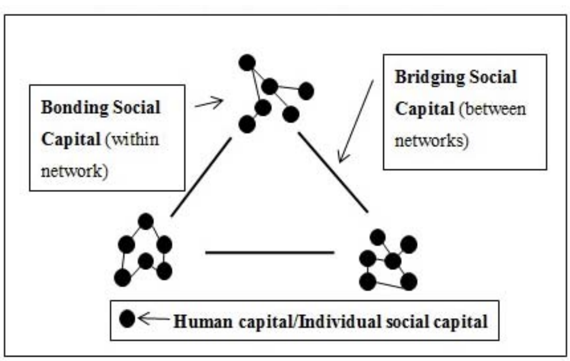
The other is to promote knowledge transfer among networks to make industrial clusters more competitive (Inkpen and Tsang 2005; Urata and Itoh 1994). It is known from Otsuka and Sonobe (2011a) and related various empirical studies (Sonobe, Suzuki, and Otsuka 2011; Kuchiki and Tsuji 2008) that without introducing new ideas and knowledge, industrial clusters never sustainably grow.

3. Testable hypothesis

In social capital literature, the concept has been categorized into two types: bonding and bridging (Narayan 1999) (fig. 10). 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. The same social capital that gives the members privileged access to certain resources could exclude non-members from access (Portes 1998, Arrow 2000).[6] 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. It is well known that the FDNY (the Fire Department of the City of New York) is dominated by Italian Americans, and the diamond trade in New York is dominated by Jewish dealers. The mafia and the caste system in certain parts of south Asia are extreme examples. 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). 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.

Figure 10. Bonding and bridging social capital



(Modified by this author based on Aldrich (2012))

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

To translate these arguments into a testable hypothesis, this paper 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 paper 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.

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

Following the New Keynesian Phillips 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 the social capital variable, and $HC_{i,t}$ is human capital. As the social capital variable, the following three proxy variables will be used. The possible proxies to be used from past literature are as follows: PTA (Putnam 2001; Coleman 1988); Living arrangements with parents, intensity of interactions with parents (Teachman, Paasch and Carver 1997); crime rate (Putnam 2001); and newspaper reading (Putnam 1996) among others. Due to the 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 households with three generations living together (=number of households with three generations/number of all household members in a ward).'

Table 3. Variables for bridging and bonding social capital

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

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

$\textit{population growth}_{i,t}$ 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 paper used the standard panel estimation (random effects (RE); fixed effects (FE); pooling cross section across time), Prais-Winsten estimation and system GMM (Generalized Method of Moments). Since this model is a dynamic model containing a lagged dependent variable in the right hand of the equation, this paper uses a Prais-Winsten 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 RE, FE 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 caused by the lagged dependent variable. 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 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 differences 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 uses one-step estimation, and implements the Hansen test and Sargan test for joint validity of the instruments, and also implements the AR test for autocorrelation.

5. Data

For the empirical study, this paper uses the variables listed in Table 4. 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 three generations living together. Both are population rate. One is the number of members 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. The population rate of university graduates is human capital proxy, and the university graduates number is divided by population.

Table 4. Descriptive statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
Employment growth rate in tertiary industry	36	1.022868	14.42606	-27.88066	49.23398
Population Growth Rate	36	1.305278	12.75325	-29.28	40.1
Share of members of households with three generations living together	36	3.679265	1.647733	1.366254	7.535136
Share of households with three generations 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 graduats from universities	18	15.9988	4.502186	8.613366	25.93723

6. Estimation results

Tables 5 and 6 show estimation results. Models 1 to 4 of Table 5 show that the share of members of households with three generations living together becomes significantly positive. Further, the human capital variable (graduates from university) also becomes positive. To double check the importance of social capital, this paper also used the share of households with three generations 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 every 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 standard panel 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 paper checked the effects of crime rate. Models 9 and 10 did not become statistically significant by RE and pooling estimations. Models 11 and 12 of Table 6 show that the crime rate is negatively correlated with unemployment and statistically significant by Prais-Winsten. 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, Model 13 checked the results with the system-GMM (one step). The results also confirmed that both households with three generations living together and crime rate became significant. Hence, regarding the social capital variable, we would be able to say that these are robust results. Therefore, the results are concordant with the hypotheses on bonding (number of members of households with three generation living together) and bridging (represented by crime rate), which were proved to be statistically significant.

Table 5. Estimation results 1 (Dependent variable: Employment growth rate in tertiary industry)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	FE	RE	pooling	Prais-Winsten	FE	RE	pooling	Prais-Winsten
Employment growth rate 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]***
Share of households with three generations living together					4.1397 [3.62]***	1.5247 [3.57]***	1.5247 [3.57]***	1.4519 [4.46]***
Share of members of households with three generations living together	2.6208 [1.80]	1.6006 [4.98]***	1.6006 [4.98]***	1.6155 [6.52]***				
Population rate of graduates from university	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

Table 6. Estimation results 2 (Dependent variable: Employment growth rate in tertiary industry)

	Model 9	Model 10	Model 11	Model 12	Model
	RE	pooling	Prais-Winsten	Prais-Winsten	System GMM
Employment growth rate 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]***
Share of members of households with three generations living together	0.8926 [3.26]***	0.8926 [3.26]***	0.7153 [3.98]***		0.1401 [2.09]**
Growth rate of members of households with three generations living together				0.3542 [5.76]***	
_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

7. Conclusions

Our analysis of employment in the tertiary industry of Kobe after the earthquake proves that social capital is an important factor 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 paper provides hints for the on-going debate on how to rebuild Tohoku.

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