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Livelihood Recovery after Natural Disasters and the Role of Aid: The Case of the 2006 Yogyakarta Earthquake

Abstract:

The 27 May 2006 Yogyakarta earthquake caused the death of more than 5.7 thousand people, more than 60 thousand people were injured and hundreds of thousands lost their houses. Bantul district was the most severely affected by the earthquake. This paper is an attempt to understand the determinants of livelihood recovery after this natural disaster and, in particular, the role of aid in that recovery process. A panel firm level survey was conducted visiting around 500 mostly small and micro enterprises in Bantul district twice: 6 months and a year after the earthquake. This paper argues that (1) smaller enterprises are more resilient and so able to bounce back faster, (2) an industrial cluster system within a subdistrict does provide support needed by firms to recover, (3) the quality of village infrastructure could be important, (4) it is important for donors not to give too much assurance of financial support to enterprises, but rather just to distribute it when it is actually available. The faster it is distributed, the better the impact on enterprises affected by the earthquake, and (4) although over a longer period of time, the effectiveness of aid might well diminish, aid does improve a firm's ability to survive.

Keywords: Micro and small enterprise, industrial organisation, development economics and natural disasters

JEL: L20, O10, R58

1. Introduction

The calamity of the December 2004 Indian Ocean tsunami shocked the world into realising how devastating the impacts of natural disasters can be on people in developing countries; in this case India, Indonesia, Malaysia, Maldives, Myanmar, Somalia, Sri Lanka and Thailand. Since then the world has started to pay even more attention to natural disasters taking place in developing countries and has contributed more generous funding for the recovery process, though not as much as natural disaster funding in developed countries, (Athukorala and Resosudarmo, 2005).

Equally important, further research has been conducted to develop effective policies regarding mitigating the impacts of natural disasters and on post-disaster recovery. Among others are the works by Jayasuriya, Steele and Weerakoon (2005), Telford, Cosgrave and Houghton (2006), Nazara and Resosudarmo (2007), Barbier (2008) as well as those of institutions such as the World Bank (2008), ADB (2005) and UNDP (2005a and 2005b). Various recent works on post-disaster recovery state the need to have proper policies to rebuild the livelihoods of people affected by natural disasters effectively and within a reasonable time period, whereas up until now the major focus of post-disaster recovery has been on building houses and infrastructures (Christoplos, 2006; Nazara and Resosudarmo, 2007; Jayasuriya and McCawley, 2008).

How progress with recovery after the 2004 Indian tsunami in Aceh can illustrate the issue of livelihood is as follows. By the end of 2006, or two years after the disaster, the Indonesian government proudly announced, among other achievements, the reconstruction of around 60 thousand out of 110 thousand houses, 1,200 km out of 3,000 km road, 11 out of 14 ferry terminals and around 700 out of 2,000 schools. However, a major dissatisfaction among local people with the recovery process has been the lack of restoration of their livelihood (Nazara and Resosudarmo, 2007). There is not enough understanding as to how to develop strategies and how to channel aid to accelerate the recovery of livelihood of people affected by natural disasters.

This paper is an attempt to understand the determinants of livelihood recovery after a natural disaster and, in particular, the role of aid in that recovery process. It focuses on the recovery of micro, small and medium (both formal and informal) enterprises after the 2006 Yogyakarta earthquake. In most developing countries, such enterprises are the source of livelihood for many poor people, particularly those living in urban and surrounding areas.

The 27 May 2006 Yogyakarta earthquake measured 6.3 on the Richter Scale and caused the death of more than 5.7 thousand people, more than 60 thousand people were injured, hundreds of thousands lost their houses and 2 million or half Yogyakarta province's population were affected. Hence this is one of the more significant natural disasters to affect the world.

In particular, this paper tries to answer the following questions: (1) what firm characteristics are among the determinants of the recovery rate of micro, small and medium enterprises? (2) in general, was receiving aid a significant determinant of the recovery rate? (3) was the expectation of receiving aid a strong motivation to recover faster or did it create a tendency to wait until the receipt of aid, thus maybe slowing recovery? (4) was an unfulfilled expectation of receiving aid harmful? and (5) was receiving aid in time an important factor?[2]

This paper conducted a panel firm level survey visiting around 500 mostly small and micro enterprises in Bantul district twice: 6 months and a year after the earthquake. Bantul is the district within Yogyakarta most affected by the earthquake and home to more than 20 thousand small and micro enterprises. The definition of micro, small and medium enterprises is firms with about 100 or fewer workers. They can be registered firms (part of the formal sector) or not (part of the informal sector). The definition of aid in this paper is limited to grants (cash or in-kinds), which can come from the government, local organisations or international donors. The main reasons for doing this are (1) the grant amount flowing into a region affected by natural disasters is typically significant and has been the main issue regarding aid related to natural disasters, and (2) information concerning who receives grants and the definition of grants has been more transparent and better defined than information on cheap credit or other subsidies.

The outline in this paper is as follows. Following the introduction is a section giving a general description of the 2006 Yogyakarta earthquake, its impact and the management of the recovery processes. The next section discusses some literature reviews on this subject and the econometric model that will be utilised. The data gathering and survey section describes the procedure of the firm surveys and some description of the variables gathered in the survey. This paper then utilises results from the estimates of the econometric model to answer the five main questions in this paper. Finally, this paper ends with a conclusion.

2. The 2006 Yogyakarta Earthquake

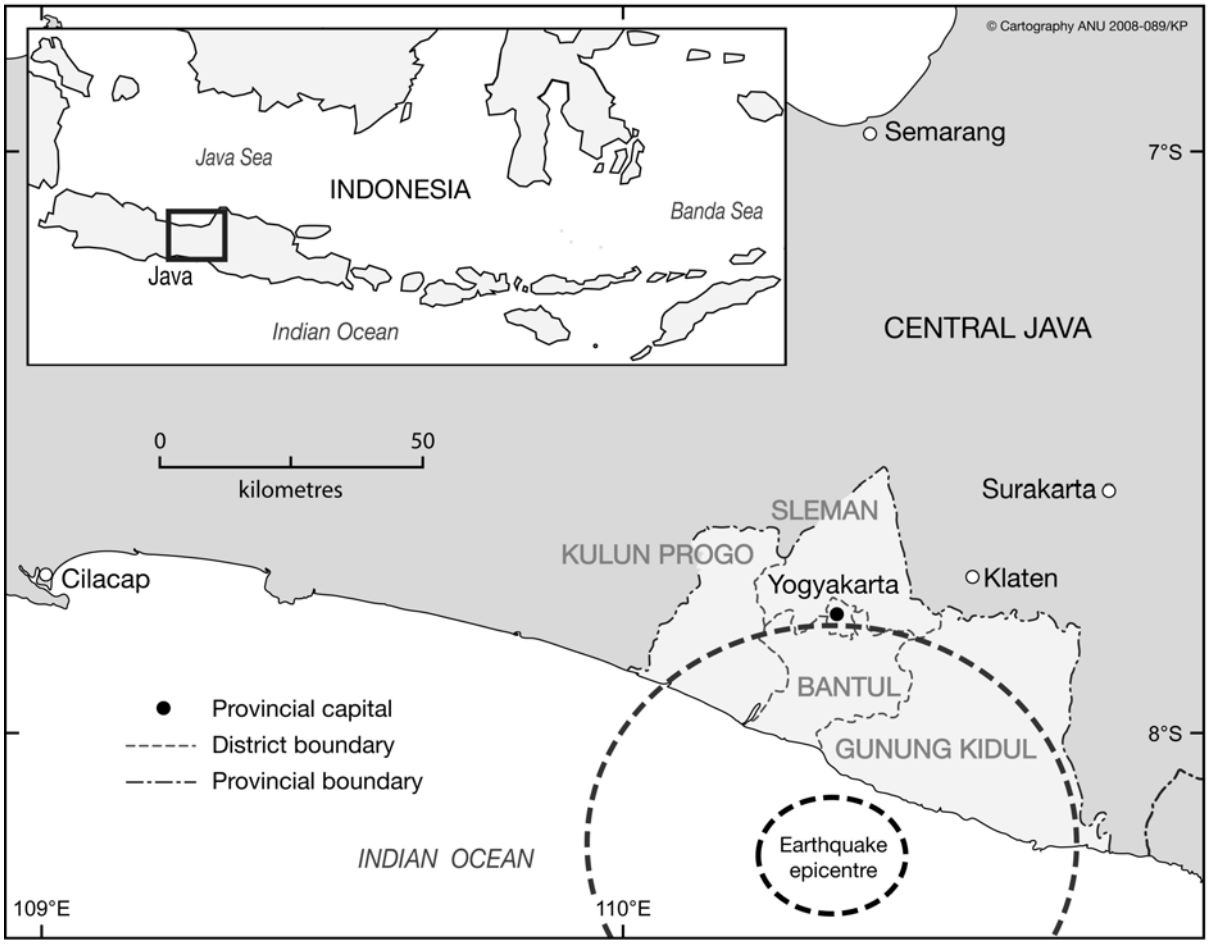
[2] This paper defines in time as within 3 months after the disaster.

Yogyakarta province is located in the centre of Java Island. Its population was about 3.2 million in 2004 or around 1.5 percent of the Indonesian population. With an average density of about 1,047 people per km^2, it is one of the most populated provinces in Indonesia. Yogyakarta's gross domestic product (GDP) per capita was approximately US$ 719 in 2004 or about 60 percent of the national average. Poverty is certainly an issue, with around 19 percent of its population considered poor.

Yogyakarta province consists of a municipality and 4 districts: the city of Yogyakarta, Bantul, Sleman, Kulon Progo and Gunung Kidul districts.[3] Micro, small and medium enterprises (MSMEs) dominate business. So far there is no data related to micro enterprise; i.e. how many there are and how many people work for them. Data has only been available for small, medium and large enterprises. In 2005, there were estimated to be about 117 thousand enterprises, of which 97 percent were small and medium enterprises with 650 thousand people working for them. Of these 650 thousand workers, 65 percent worked in small and medium enterprises. It is estimated that around 21 thousand of these small and medium enterprises are in Bantul district.

An earthquake measuring 6.3 on the Richter Scale hit Yogyakarta and some areas of Central Java, on Saturday morning, 27 May 2006, causing widespread destruction, loss of life and property (Map 1). The death toll was estimated at over 5,700, with estimated injuries up to 37,900. At least 156,700 buildings were totally destroyed, and over 200,000 suffered varying degrees of damage. All damaged buildings inspected showed a lack of seismic design provisions, adequate robustness considerations and/or poor quality of construction (Bappenas et al., 2006).

[3] It is important to note that within Yogyakarta province there is a municipality of Yogyakarta. In this paper, 'Yogyakarta' always refers to Yogyakarta province. 'The city of Yogyakarta' or 'Yogyakarta city' will be used when referring to the municipality of Yogyakarta.



Map 1. Yogyakarta Province and the 27 May 2006 Earthquake Epicentre

Bantul district was the most severely affected by the earthquake, the death toll was around 4,100 while the number of injured was 12,000. The Bappenas (2006) joint team estimated that the total physical damage cost in Bantul reached approximately 246 percent of its GDRP and affected more than 100 thousand micro, small, and medium enterprises. Table 1 summarises the damages caused by the earthquake.

Table 1. Summary of Estimated Damages Caused by the Earthquake

	Central Java Province	Yogyakarta Province (including Bantul District)	Bantul District
Human	1,100 death toll, 18,500 injured	4,600 death toll, 19,400 injured	4,100 death toll, 12,000 injured
Housing	68,500 houses destroyed, 103,800 damaged	88,200 houses destroyed, 98,200 damaged	72,000 houses destroyed, 137,000 damaged
Education	725 school buildings destroyed	2,200 school buildings destroyed (1,900 primary schools)	950 school building destroyed
Health	1 hospitals, 16 health centres, 56 health posts damaged or destroyed	17 hospitals, 117 health centres, 324 health posts damaged or destroyed	26 health centres and 67 health posts damaged or destroyed

Transportation	relatively minor damage	relatively minor damage	relatively minor damage
Communication	minor disruption	minor disruption	minor disruption
Electricity	few days of disruption	few days of disruption	few days of disruption
Water supply	minor disruption and few leaks	minor disruption and few leaks	minor disruption and few leaks
Public and social facilities	12 social facilities affected, 827 religious facilities damaged	67 social facilities affected, 10-20% of total religious buildings (2,200 facilities) affected, Prambanan temple heavily damaged	n.a.
Business	7,860 SMEs affected	21,760 SMEs affected, 6 major hotels damaged	75% of total enterprises affected (including 14,620 SMEs)
Market facilities	10 traditional markets damaged	85 traditional markets damaged	17 traditional market damaged

Source: Bappenas et al., 2006
Note: n.a. = no information available

Responses from local and international donors to help people affected by the earthquake were overwhelming. Within a week Yogyakarta was inundated by many of these organisations. The downside was that their various uncoordinated activities created traffic congestion, hampering help needed by those in more remote areas.

The rescue activities were mostly conducted by local people and organisations, including the military and Indonesian Red Cross. Their main activities were to give medical aid to those who were injured as soon as possible, to free people trapped in rubble and to bury the dead. Food and survival funds were also distributed within a week after the disaster through the provincial disaster response agency: (1) Rp 90 thousand (US$ 10) per person for disaster compensation, (2) 10 kg of rice per person, (3) free medical treatment, and (4) temporary shelters. During the second week after the disaster, preparations for recovery activities began with the registration of all participating organisations and grouping them into several clusters dealing with similar activities.

The recovery activities themselves started a month after the disaster. In Yogyakarta province, from October 2006, approximately 70 percent of households affected were given Rp 15 million (US$ 1,613) per household to construct or renovate their houses. Households were expected to manage the reconstruction themselves using the funds given. A few were given new houses constructed by donors. The rest were not given any housing support, since their houses were considered to be minimally damaged (JRF, 2007). Some school and public reconstruction activities commenced in the second month after the earthquake. Most of these activities were conducted by government and donor agencies.

A recovery of livelihood program was also introduced in the second month after the earthquake. In general, the objectives were as follows: (1) to enhance access to finance linked to technical assistance for micro and small enterprises, (2) to support defaulting lenders to develop effective strategies for viable enterprises, and (3) to establish soft-loan mechanisms to rehabilitate damaged medium-size business infrastructure and capital equipment (JFR, 2008). The government has not been able to control the implementation of these objectives fully due to so many organisations being involved. For example: not all micro and small enterprises received financial support in terms of cash or in-kinds, whereas some medium enterprises did, though not many.

It is rather difficult to record how much funding actually has been spent on the recovery process in Yogyakarta and the Central Java provinces. However, data from the Indonesian government and the Java Reconstruction Fund (JRF)[4] is available. By June 2008, the government had spent approximately Rp 5.4 trillion (US$ 570 million) on housing and the JRF as much as around US$ 60 million of their total US$ 84 million commitment to various activities, mostly housing. It is even more difficult to trace how much funding has been allocated for livelihood recovery, but most likely it has been much less than that for housing. For example, the JRF made a commitment to spend US$ 14.34 million for livelihood recovery programs, mostly to support the recovery of micro, small and medium enterprises in Yogyakarta and the Central Java provinces (JRF, 2008). The main interest of this paper is to observe how effective livelihood recovery support has been, particularly the recovery of micro, small and medium enterprises.

3. Methodology

Literature on the impact of large shocks on firm performances has been abundant. Recently many works have been established to analyse the impact of the 1997/98 Asian crisis on firm performances in countries most affected by the crisis. Examples include the works by Fukuchi (2000), Sato (2000) and Narjoko and Hill (2007) in the case of Indonesia, by Rungsomboon (2005) and Dekle et al (2005) in the case of Thailand, by Lim and Han (2003), Kang and Kim (2006) and Oh et al. (2008) in the case of Korea, and by Dwor-Frecaut et al. (2000), Mitton (2002), Hew and Loi (2004), Chen and Hsu (2005) as well as Harvie and Lee (2005) for multi-country comparative analysis.

[4] The Java Reconstruction Fund is a multidonor reconstruction fund pledged by the European Commission, the Netherlands, the United Kingdom, Canada, Finland and Denmark. It is governed by a Steering Committee and co-chaired by the Government of Indonesia and the European Commission with the World Bank as Trustee.

The typical model utilised for this Asian crisis is observing the relationship between firm performances, measured by either output, value added or total factor productivity, on the left hand side and firm and industrial/market characteristics on the right hand side; i.e. models emerged out of the structure, conduct and performance literature (Bain, 1956; Shepherd, 1972; Scherer and Ross, 1990). Most of this literature aims to explain why the impacts of the crisis vary across firms, even within the same industrial category. Most of this literature utilises data sets of medium and large firm-level surveys to achieve this goal. In general, it concludes that the impact variation across firms can be explained by firm characteristics—such as ownership, size, financial pressure, age, location, economy of scale and export orientation—and industrial/market characteristics—such as industry factor intensity, product market competition and protection. It is important to note that little of this literature actually focuses on observing the determinant of firm recovery and analysis focuses on medium, small and micro enterprises.

Literature on the role of aid—broadly defined to include government and non-governmental organisation interventions—on the development of micro, small and medium enterprise (MSME) has been relatively plentiful. The focus is mostly on the role cheap credit provision and input subsidies play in a firm's performance (King and Levine, 1993; World Bank, 1994; AusAID, 2000; Batra and Mahmood, 2001; Beck et al., 2004; Levine, 2006). So far the conclusion is ambiguous. Some literature supports the argument that aid will develop MSMEs on the basis that they are typically productive but that they face some constraints to development, for example access to credit, some material inputs and proper information. Hence, if aid can be delivered to eliminate these obstacles, MSMEs will grow even faster (World Bank, 2001; Levine, 2006). On the other hand, some argue that aid might not effectively support MSME development, at least on the medium to long-term horizon. Aid and intervention could reduce the competitiveness of MSMEs. Furthermore when the business environment is bad—due to too much regulation, the existence of entry barriers etc.—MSMEs will not be developed anyway, with or without aid (Levine, 2006).

The contribution of this paper and the model that will be developed are (1) a model that is appropriate to analyse factors determining the recovery rate of MSMEs after a large external shock, in this case a natural disaster, and (2) a model to confirm the effectiveness of aid in MSMEs' recovery processes.

3.1. The Model

Recall that the model that will be developed in this section will be utilised to understand the determinants of micro, small and medium enterprise recovery rate in the Bantul district after the 2006 Yogyakarta earthquake. The Bantul district consists of 17 subdistricts (*kecamatan*) and 76 villages.

Let us define $Y_{i,-1}$ as the average monthly sales of firm *i* before the earthquake, $Y_{i,0}$ as the first month sales of firm *i* just after the earthquake, and *Yi,t* as the monthly sales of firm *i* at *t* month after the earthquake. Firm initial damage due to the earthquake can be defined as:

$$ID_i = \frac{(Y_{i,-1} - Y_{i,0})}{Y_{i,-1}} \quad (1)$$

and the damage level left at *t* months after the earthquake as

$$D_{i,t} = \frac{(Y_{i,-1} - Y_{i,t})}{Y_{i,-1}} \quad (2)$$

The firm rate for firm *i* at *t* month after the earthquake, hence, can be calculated as

$$R_{i,t} = \frac{(ID_i - D_{i,t})}{ID_i}.100\% \text{ for } \frac{(ID_i - D_{i,t})}{ID_i} < 1 \quad (3a)$$

or

$$R_{i,t} = 100\% \text{ for } \frac{(ID_i - D_{i,t})}{ID_i} \geq 1 \quad (3b)$$

Please note that with this formula, this paper standardises the rate of recovery across firms toward their initial levels of damage.

On the determinants of this recovery rate, this paper adopts models typically used in the Asian crisis literature and adds a variable for grant:

$$R_{i,t} = f(\boldsymbol{x}_t, g_{i,t}, t) \quad (4)$$

where $\boldsymbol{x}_t$ is a vector consisting of a firm's initial damage (ID_i) measured by the drop in sales due to the earthquake, firm characteristics (size in number of workers, amount of assets per worker, location where majority of workers come from, amount of loan per worker, whether it markets the product only to Yogyakarta or elsewhere as well, and number of years that the firm has been established), owner characteristics (gender, experience measured by years of working in this industry and whether or not the owner has other sources of income), village characteristics (distance to the centre of Yogyakarta city, age of village head and her/his education level), and industrial characteristics (dummy for 1 digit ISIC and size of industrial cluster measured by the ratio between the number of firms with the same 3 digit ISIC and the total number of firms in a subdistrict or *kecamatan*). In this model, firm and industrial characteristics are measured at the average 4 month situation before the earthquake. Variable $g_{i,t}$ is the total amount of grant per worker received by firm *i* up until *t* month after the

earthquake. Please also note that when this model applies to a cross-section data set, the variable *t* which is the number of months after the earthquake, can be dropped from the model and so for a cross-section empirical work the model can be written as:

$$R_{i,t} = \alpha + \boldsymbol{\beta}.x_i + \delta.g_{i,t} + e_i \quad (5)$$

where e_i is a white random error.

The first hypothesises in this paper is H_0: $\beta_x = 0$ vs H_1: $\beta_x \neq 0$ for all $\beta_x \in \boldsymbol{\beta}$. The second hypothesis is H_0: $\delta = 0$ vs H_1: $\delta \neq 0$. The expected sign is positive; i.e. the larger the amount of grant per worker received by a firm, the faster its recovery process.

The next step is to extend the model so that the impact of expecting to receive a grant ('announcement effect') can be observed. This can be done simply by adding the model in equation (5) with a dummy variable ($dg1_i$) whether or not firm *i*, within the first two months after the earthquake, is approached by an individual or institutional donor who promises to give a grant to the firm ($dg1_i = 1$ for yes and $dg1_i = 0$ for otherwise):

$$R_{i,t} = \alpha + \boldsymbol{\beta}.x_i + \gamma.dg1_i + \delta.g_{i,t} + e_i \quad (6)$$

The hypothesis is then H_0: $\gamma = 0$ vs H_1: $\gamma \neq 0$. The existing literature, if any, does not say much about what the sign of this γ should be. Opposite arguments nevertheless can be developed. First the sign of γ is positive since having an expectation to receive some aid will encourage the owner and workers to continue working at the firm and so induce a positive impact on the firm's recovery rate. Second the sign of γ will be negative, since there is a tendency for the firm to wait till it actually receives the aid before working towards the firm's recovery.

The weakness of the model in equation (5) is as follows. Consider the following four combinations of events. First, the recovery rate of firm *i* if it does not receive a promise of any grant and actually does not receive any is:

$$E[R_{i,t} \mid_{dg1_i=0, g_{i,t}=0, x_i}] = \alpha \quad (7)$$

Second, the recovery rate of firm *i* if it does receive a promise of a grant, but then does not receive it, is:

$$E[R_{i,t} \mid_{dg1_i=1, g_{i,t}=0, x_i}] = \alpha + \gamma' \quad (8)$$

Third, the recovery rate of firm *i* if it does not receive a promise of a grant, but then receives one, is:

$$E[R_{i,t} \mid_{dg1_i=0, g_{i,t}>0, x_i}] = \alpha + \delta.g_{i,t} \quad (9)$$

Fourth, the recovery rate of firm *i* if it does receive a promise of a grant and then it actually receives it is:

$$E[R_{i,t} \mid_{dg1_i=0, g_{i,t}>0, x_i}] = \alpha + \delta . g_{i,t} + \gamma'' \quad (10)$$

Subtracting (8) from (7) produces γ' which is the different rate of recovery between two identical firms that do not receive any grant, but one of them receives a promise to receive a grant; i.e. γ' is the impact of receiving a promise to receive a grant among firms that do not receive any grant.

Subtracting (10) from (9) produces γ'' which is the different rate of recovery between two identical firms both of which do receive the same amount of grant, but one of them receives a promise to receive a grant before receiving it; i.e. γ'' is the impact of a promise to receive a grant among firms which do receive the same amount of grant. The model in equation (5) forces γ' to be equal to γ''; i.e. $\gamma' = \gamma'' = \gamma$. In reality, it is possible to find a situation where $\gamma' \neq \gamma''$. One could argue that $\gamma' < \gamma''$. Meaning that, where giving a promise is beneficial, the benefit of giving the promise is higher in the case where it materialises, or where giving a promise is detrimental, the negative impact is smaller in the case where it materialises. One could even argue that the sign of γ' is negative and the sign of γ'' is positive. To capture the situation that $\gamma' \neq \gamma''$, the general model should be:

$$R_{i,t} = \alpha + \beta . x_i + \gamma' . dg1_i + \delta . g_{i,t} + \theta . dg1_i . g_{i,t} + e_i \quad (11)$$

so then $\gamma'' = \gamma' + \theta . g_{i,t}$

The model in equation (6) is fine when, first, none of the firms that do not receive a promise actually receives a grant, or, second, all firms that receive a promise actually receive the grant. The sample in this study, to be discussed later on, does not include a firm that does not receive a promise but later on receives a grant; i.e. none of the firms that do not receive a promise actually receives a grant. This paper then adopts the model in equation (6). In this case, γ means γ' or the impact of receiving a promise among firms who receive grants.′

The final extension of the firm recovery model in this paper is to include the impact of receiving aid or a grant on time, which is defined as receiving the grant (could be partially) within the first three months after the earthquake ($dg2_i = 1$ if firm *i* receives the grant within the first three months after the earthquake and $dg2_i = 0$ if otherwise). The model is as follows:

$$R_{i,t} = \alpha + \beta . x_i + \gamma . dg1_i + \delta . g_{i,t} + \rho . dg2_i . g_{i,t} + e_i \quad (12)$$

where $\rho.g_{i,t}$ is the impact of receiving grant as much as $g_{i,t}$ in time for firm i compared with if it receives a grant but not in time. The hypothesis is that H_0: $\rho = 0$ vs H_1: $\rho \neq 0$; i.e. receiving grant in time helps a firm to recover faster.

To clarify the situations that are observed in this paper, a picture is needed to represent all the hypotheses. Let us assume for the moment that receiving a promise is beneficial to a firm's recovery rate for the reason that has been previously discussed. Figure 1 shows the situation that this paper expects to observe.

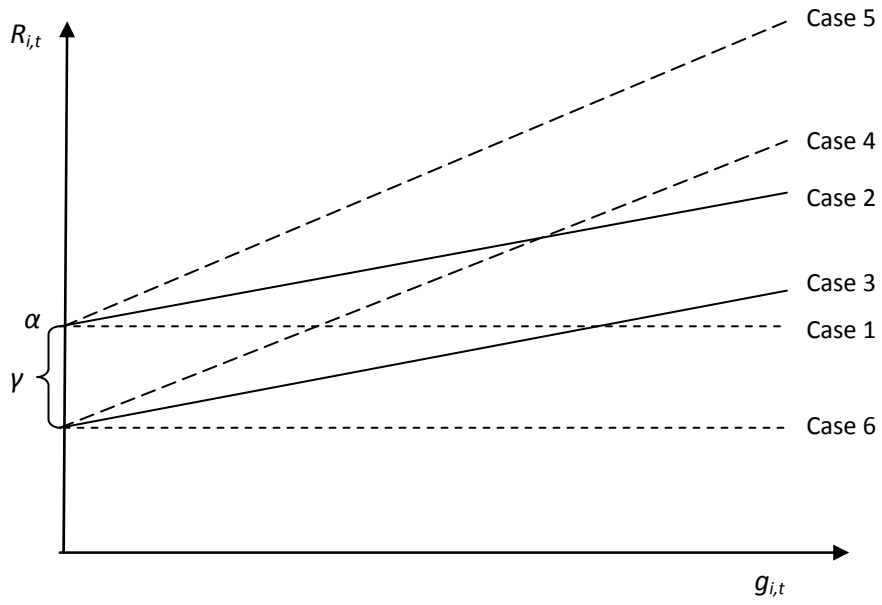


Figure 1. Firm's Recovery Rate in Various Cases.

The explanation of the various cases in Figure 1 is as follows:

- Case 1 is the expected recovery rate of a firm which does not receive any promise to receive any grant and does not receive any: $E[R_{i,t} \mid_{dg1_i=0, g_{i,t}=0, dg2_i=0, x_i}]$
- Case 2 is the expected recovery rate of a firm which does not receive any promise to receive any grant, then does receive a grant, but not in time (more than 3 months after the earthquake): $E[R_{i,t} \mid_{dg1_i=0, g_{i,t}>0, dg2_i=0, x_i}]$
- Case 3 is the expected recovery rate of a firm which does receive a promise to receive a grant, and it actually receives a grant, but not in time (more than 3 months after the earthquake): $E[R_{i,t} \mid_{dg1_i=1, g_{i,t}>0, dg2_i=0, x_i}]$

- Case 4 is the expected recovery rate of a firm which does receive a promise to receive a grant, it then receives it, and in time (within 3 months after the earthquake): $E[R_{i,t} \mid_{dg1_i=1, g_{i,t}>0, dg2_i=1, x_i}]$
- Case 5 is the expected recovery rate of a firm which not does receive a promise to receive a grant, but then receives it, and in time (within 3 months after the earthquake): $E[R_{i,t} \mid_{dg1_i=0, g_{i,t}>0, dg2_i=1, x_i}]$
- Case 6 is the expected recovery rate of a firm that does receive a promise to receive a grant and does not receive it: $E[R_{i,t} \mid_{dg1_i=1, g_{i,t}=0, dg2_i=0, x_i}]$.

From Figure 1, it can be seen that, in the case where receiving a promise is harmful, case 5 is the dominant case. It is important to note that, with the model in equation (6), if receiving a promise is beneficial, case 4 would be the dominant case.

3.2. Estimation Strategy

The first step is to implement the Ordinary Least Square (OLS) estimation on the data set containing only firms affected by the earthquake but which survive to estimate the relationships in equation (5), (6) and (12). It is expected that the industrial/market characteristics (size of industrial cluster and dummy for 1 digit ISIC) work well to control variation across types of industry and so eliminate correlations among errors from firms with the same industrial characteristic. However, there are three areas where it is suspected that the OLS estimation suffers.

The first issue is an endogeneity problem. It is suspected that those who receive a grant are the ones expected to have a slow rate of recovery. This paper will conduct the Durbin-Wu-Hausman test to test whether or not the OLS estimation suffers an endogeneity estimation bias (Green, 2003). If so, the Instrumental Variable (IV) estimation will be conducted to solve the issue of endogeneity.

The second issue is a location correlation problem. Firms located in the same area might share the same information and so adopt a similar recovery strategy, and so their recovery rates are correlated. In the OLS estimation, this problem results in error terms across location are not homoscedasticity. To eliminate or at least reduce this problem, this paper clusters the error terms at subdistrict (*kecamatan*) level. Unfortunately, although it would be better if this paper could do so at village level, this level of cluster is not possible, since, in the data set utilised, there are villages with very few observations.

The third issue is a selection bias problem. There are firms affected by the earthquake that decided to close down. Without taking into account these firms, the OLS estimation suffers a selection bias problem which, in general, overestimates all parameters in the model. To overcome this problem, this paper utilises the Heckman estimation on the data set containing firms affected (Heckman, 1979; Green, 2003). Some of these firms survive and others decide to close down. The model for the censored is:

$$P[R_{i,t} \geq 0] = \mu + \pi.\boldsymbol{z}_i + \tau.dg1_i + \varphi.g_{i,t} + \varepsilon_i \quad (13)$$

where $\boldsymbol{\pi}$ is a vector containing firm *i*'s level of building damage caused by the earthquake, its characteristics (size in number of workers, amount of assets per worker, location where majority of workers come from, amount of loan per worker, whether it markets the product only to Yogyakarta or elsewhere as well, and number of years that the firm has been established), owner characteristics (gender, experience measured by years of working in this industry and whether or not the owner has other sources of income), village characteristics (distance to the centre of Yogyakarta city, age of village head and her/his education level), and industrial characteristics (dummy for 1 digit ISIC and size of industrial cluster measured by the ratio between the number of firms with the same 3 digit ISIC and the total number of firms in a subdistrict). ε_i is a random variable.

4. Data Gathering

The main data set for this paper was collected through a community survey, conducted in January 2007, and two firm level surveys conducted in February 2007 (six months after the earthquake) and in August 2007 (one year after the earthquake) in Bantul district.

4.1. Survey Design

A village community survey was conducted since reliable information on exact addresses of MSMEs in Bantul district, and even how many there are, is not available. Bappenas et al. (2006) estimated that there are around 11,000 MSMEs in Bantul, but this number is difficult to confirm and addresses of the enterprises are not available. The regional office of Industry, Trade and Cooperation only has address lists of those enterprises that register with them to attend training provided by the office; they don't know the total number of enterprises or whether or not they are still operating.

In the community survey, the head or a senior member of each village in Bantul district was interviewed. During the interview we gathered the village's data on the number of MSMEs in the village and their location as well as other village characteristics, in particular the gender and education level of the village head and the distance of the village office from the central city of Yogyakarta. From this community survey, this paper develops the sample for the firm-level survey. The ratio of the sample per village to the total sample is equal to the ratio of MSMEs in the village to the total number of MSMEs in Bantul district based on the community survey. Within a village a random sample method is applied. Neither a stratification technique between micro, small and medium enterprises nor between ISIC codes is applied due to lack of information on size and classification of firms available in village offices.

The first firm-level survey was conducted in February 2007. Approximately 500 firms were interviewed in this survey. The main firm and owner characteristics questions concerned (1) type of main product, (2) average monthly sale before the earthquake—typically the average of the last four months (January till April 2006), (3) monthly sale in the first month after the earthquake (June 2006), (4) monthly sale last month (January 2007), (5) average number of workers involved before the earthquake and location of their homes or dwellings, (6) total amounts of assets and loans before the earthquake, (7) marketing area (Yogyakarta province only or outside the province as well), (8) year of the firm was established, (9) gender of owner, (10) years of owner experience in this industry and (11) owner's other sources of income. The main questions related to receiving aid concerned (1) receiving a promise from anyone (individual or institution) that the firm would receive some financial support, (2) the time that the support (could be part of it) was actually received, and (3) how much in total so far.

The second-firm level survey was conducted in August 2007, revisiting the firms visited in the first survey. A much shorter interview was conducted mainly asking the following questions about the firm's current condition: (1) monthly sale last month (July 2007) and (2) additional grant received.

4.2. Scope of the Sample

In Bantul district there are 17 subdistricts and within these subdistricts there are 76 villages. On average there are 4 villages per subdistrict, though there are subdistricts with 8 villages and one with only 2 villages. The total number of micro, small and medium enterprises in Bantul district based on the community survey is 35,024 enterprises. The average number of

MSMEs per village is 461 enterprises, with a maximum number of around 2,000 enterprises per village and a minimum of 15. Of the total target of 500 enterprises, 498 agreed to be interviewed.

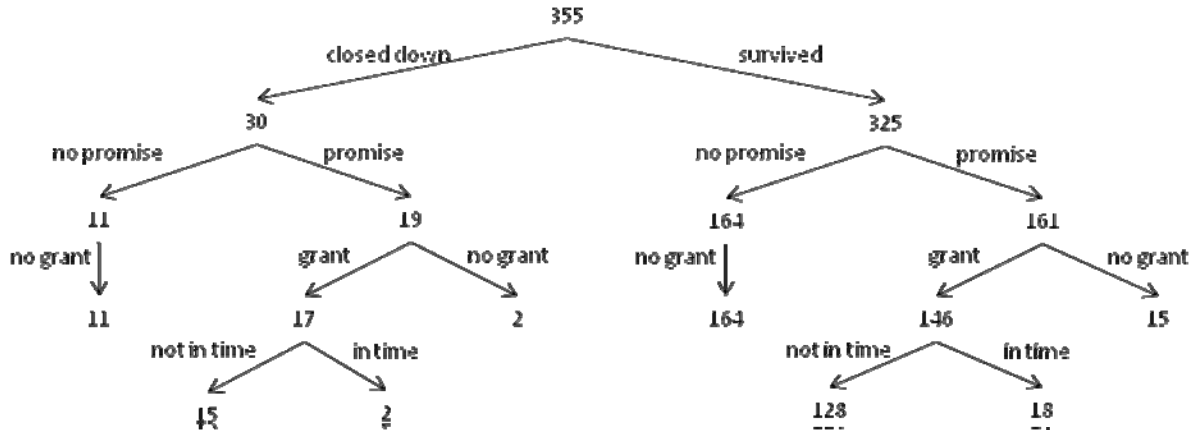
4.3. Firm Dynamic within the Sample

The first firm-level survey revealed that, of the 498 enterprises in the sample, 143 enterprises were not affected by the earthquake, i.e. they did not experience a reduction in their sales due to the earthquake.[5] Of the 355 enterprises affected, 30 of them decided to close down by February 2007, even though some of them received grants in terms of cash or in-kind. Of the 355 enterprises that survived, 161 enterprises were promised some financial support, but only 146 enterprises had received it by February 2007. Of those receiving grants, only 18 enterprises received the grant within 3 months after the earthquake. Figure 2 maps the number of enterprises that received a promise and a grant as well as those that received the grant in time.

During the second firm-level survey all enterprises visited in the first survey were able to be revisited except for one. There was not much change among enterprises observed in the first survey that had not been affected and those that had decided to close down. Those that were not affected during the first survey had been able to keep functioning, and those which had closed down had not yet reopened.[6] There were some changes to the 325 enterprises which still survived in February 2007. For example, 26 of these 325 enterprises closed down by August 2007. Some that had not received any grant by February 2007 did so between February and July 2007. Figure 3 gives a breakdown of the numbers of firms that received a grant and those that did not by August 2007.

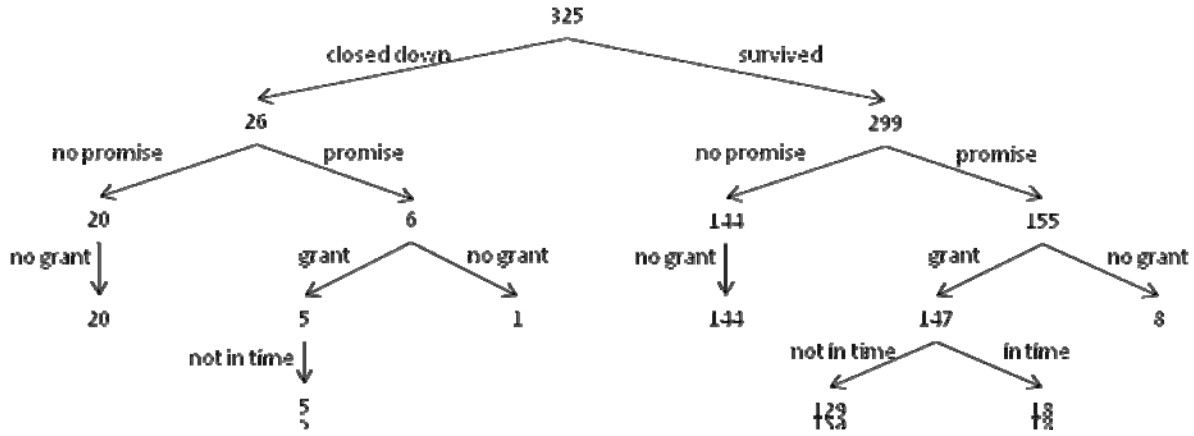
[5] Note these enterprises might have experienced some damage to the building etc., but those damages did not affect their sales.

[6] Many decided to work as construction workers or as employees of other enterprises.



Note: promised = receiving a promised that the enterprise would be receiving some grant; grant = the enterprise did actually receive some grant; in time = the enterprises received some or all of the grant within 3 months after the earthquake; later = the enterprises received some or all of the grant 3 months or more after the earthquake

Figure 2. Number of Enterprises Affected, Received Promise, Actually Received Grants and Received Grant in Time by February 2007

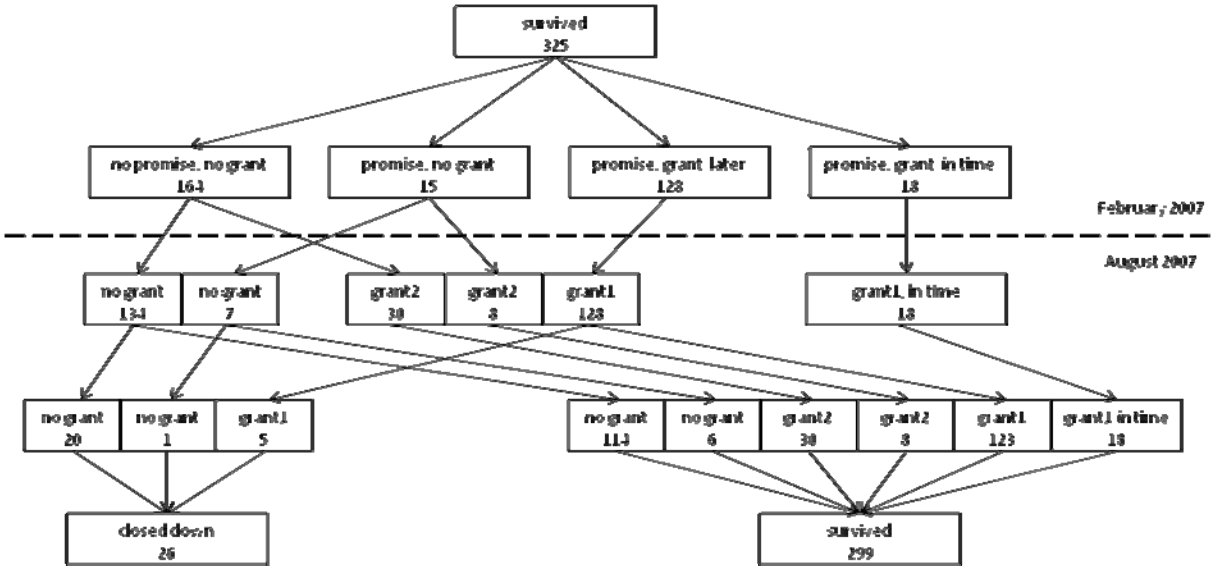


Note: promise = receiving a promised that the enterprise would be receiving some grant; grant = the enterprise did actually receive some grant; in time = the enterprises received some or all of the grant within 3 months after the earthquake; later = the enterprises received some or all of the grant 3 months or more after the earthquake

Figure 3. Number of Enterprises Affected, Received Promise, Actually Received Grants and Received Grant in Time by August 2007

Figure 4 shows the links between those surviving in February 2007 and their situation in August 2007. For example, of the 164 enterprises that by February 2007 had not received a promise of—and did not receive—a grant, 30 received a grant after February 2007 and all 30 survived, 20 closed down and the rest managed to survive without a grant. Of 15 enterprises promised a grant but not in receipt of it by February 2007, 8 enterprises finally received the

grant, 7 still had not received it, and of these 7, 1 had to close down. Another category of enterprises that closed down between February and August 2007 formed part of those 128 that received a grant before February 2007 but it was late. In general it can be seen that the majority of enterprises that closed down between February and August 2007 were those affected by the earthquake but had not received any support.



Note: grant1 = received grant by February 2007; grant2 = received grant between February and August 2007

Figure 4. Mapping of Enterprises Surviving in February 2007, but Closed Down by August 2007

5. Results and Discussion

This paper applies the estimation strategy mentioned in section 3 to data from the first survey (February 2007) and from the second survey (August 2007).

5.1. Within Six Months (February 2007)

An OLS estimation is applied to estimate the model in equation (12) using data from the first firm-level survey. This paper focuses only on analysing firms affected by the earthquake. Table 2 shows the means and ranges of variables utilised in the OLS estimation and the results of the OLS estimation can be seen in Table 3 (model 1). Correlations among variables on the right hand side seem not to be an issue; i.e. there is no serious multicollinearity issue. Omitting variable bias is most likely not an issue as indicated by the result of the Ramsey RESET test.

The first concern is whether or not there is an endogeneity problem, particularly related to the grant variable; i.e. the size of the grant is determined by the expected rate of the firm's recovery. This paper utilises the level of the firm's building damage as the instrument variable, since is does not relate to the firm's recovery rate as well as the error terms of the OLS estimation, but is significantly related to the grant. An IV estimation is then conducted and the results can also be seen in Table 3 (model 2). The P-value of the Durbin-Wu-Hausman test indicates that the OLS estimation is consistent and asymptotically efficient. Hence this paper prefers the result of the OLS estimation.

Table 2. Descriptive Statistics of Variables from the First Survey

n = 325	Unit	Mean	Std. Dev.	Min	Max
Recovery rate	%	71.67	37.61	0	100
Firm Characteristics					
Firm size (# of worker)	person	7.86	12.44	1	101
Assets per worker	Rp. million	10.96	13.11	0.01	90
Living area of most worker (Bantul = 1)		0.94	0.23	0	1
Loan per worker	Rp. million	0.47	2.21	0	35.29
Market the product only to Yogyakarta (yes = 1)		0.72	0.45	0	1
# of years the firm has been established	year	17.73	13.44	1	80
Owner Characteristics					
Owner's gender (male = 1)		0.51	0.50	0	1
Owner's experience	year	19.97	12.55	2	60
Has other source of income (yes = 1)		0.25	0.44	0	1
Village Characteristics					
Distance to the centre of Yogyakarta city	km	16.31	8.87	2	40
Village head's age	year	45.04	9.09	29	66
Village head's education	year	4.86	1.02	3	7
Industrial Characteristics					
Size of 3 digit ISIC cluster in a sub-district		0.31	0.22	0.01	0.64
Aid Characteristics					
Grant	Rp million	1.45	2.50	0	13.5
Promise to receive grant (yes = 1)		0.50	0.50	0	1
Received grant in time (yes = 1) x Grant		0.22	1.20	0	10.26
Others					
Initial damage	%	85.14	32.21	0	100

Note: For education, 1=not finished elementary, 2=finished elementary, 3=finished secondary, 4=finished high, 5=finished 2 year diploma, 6=finished university and 7=finished post graduate

Table 3. Estimation Results for the Situation within Six Months

Sale recovery rate is the independent variable	OLS (model 1)	IV (model 2)	OLS-Cluster (model 3)	Heckman-Cluster (model 4)
Firm Characteristics				
Firm size (# of worker)	-0.34**	-0.67*	-0.34	-0.38
	(0.17)	(0.39)	(0.23)	(0.23)
Assets per worker	0.16	0.40	0.16	0.16
	(0.15)	(0.29)	(0.13)	(0.14)
Living area of most worker	5.69	7.98	5.69	5.17
(Bantul = 1)	(8.20)	(9.93)	(8.80)	(8.64)
Loan per worker	0.59	-0.66	0.59	0.77
	(0.83)	(1.59)	(0.45)	(0.48)
Market the product only to Yogyakarta (yes = 1)	1.31	5.96	1.31	1.13
	(4.59)	(7.14)	(4.45)	(4.37)
# of years the firm has been established	0.22	0.19	0.22	0.21
	(0.20)	(0.24)	(0.15)	(0.14)
Owner Characteristics				
Owner's gender (male = 1)	5.29	0.62	5.29	6.56*
	(4.38)	(6.97)	(3.54)	(3.59)
Owner's experience	-0.86	-0.41	-0.86	-0.85
	(0.54)	(0.77)	(0.58)	(0.57)
Owner's experience-squared	0.01	0.00	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Has other source of income (yes = 1)	-4.88	-1.78	-4.88	-5.20
	(4.21)	(5.86)	(6.06)	(5.99)
Village Characteristics				
Distance to the centre of Yogyakarta city	-0.27	-0.14	-0.27	-0.28
	(0.26)	(0.33)	(0.19)	(0.19)
Village head's age	-0.23	-0.32	-0.23	-0.19
	(0.21)	(0.26)	(0.15)	(0.14)
Village head's education	0.33	-2.09	0.33	1.45
	(1.87)	(3.28)	(2.88)	(3.01)
Industrial Characteristics				
Dummies of 1 digit ISIC	Included	included	Included	Included
Size of 3 digit ISIC cluster in a sub-district	21.49*	15.01	21.49*	23.58*
	(11.58)	(15.11)	(10.45)	(11.47)
Aid Characteristics				
Grant	1.14	-9.72	1.14*	1.31**
	(1.01)	(10.96)	(0.60)	(0.61)
Promise to receive grant (yes = 1)	-11.61**	14.84	-11.61**	-11.47**
	(4.60)	(27.10)	(4.63)	(4.70)
Received grant in time (yes = 1) x Grant	2.28	8.38	2.28***	2.27***
	(1.62)	(6.42)	(0.64)	(0.63)
Others				
Initial damage	0.61***	0.65***	0.61***	0.60***
	(0.06)	(0.08)	(0.07)	(0.07)
Constant	55.42***	50.46*	55.42**	49.55**
	(21.42)	(25.72)	(22.03)	(22.93)
Lambda (Inverse Mills Ratio)				18.75
				(11.44)
Number of Observation	325	325	325	325
R-Squared	0.36	0.11	0.36	0.36
Ramsey test (Prob > F)	0.08		0.08	
Durbin-Wu-Hausman (P-Value)		0.22		

Note: Numbers in bracket are standard deviations; *** is significant at 1%, ** is significant at 5% and * is significant at 10%

The second issue is a location correlation problem, due to the fact that firms within the same location might share the same information and so behave almost similarly. An OLS estimation where the error terms are clustered, based on the *kecamatan* where the firms are located, or OLS-Cluster estimation (model 3), is conducted. The next issue is a selection bias problem, since several of the firms affected decided to close down. This paper conducts Heckman estimations applying equation (13) as the censored equation and clusters the error terms with *kecamatan*, or Heckman-Cluster (Table 3, models 4). Observing that the parameter lamda of the inverse mills ratio is almost significantly different than zero with a 90 per cent confidential level (i.e. significant with an 88 per cent confidential level), it is suggested that the Heckman-Cluster estimation is not necessary, but provides a better estimation. Hence this paper focuses its analysis on the results of the Heckman-Cluster estimation.

Initial damage is a significant variable in determining a firm's recovery rate. Those which were affected the most had the strongest interest in recovery. But this can also mean that, in general, the recovery trajectory is concave rather than linear. Everything being equal, there is a diminishing marginal rate to recover. None of firm characteristic variables is significantly different than zero at a 90 percent confidential level. Firm size and loan intensity or loan per worker become significantly different than zero at an 85 percent confidential level; and number of years that the firm has been established at an 84 percent. First, the smaller the firm, the faster it bounces back to its original level of production. Second, those with a higher loan were pressured or more motivated to recover faster. Finally, older firms seem to be able to recover faster. Other firm characteristics do not seem to be important determinants of its recovery rate.

With reference to owner characteristics, the owner's gender is statistically significant at the 10 percent level. Firms owned by males seem to recover faster. It is interesting to note that almost double the number of enterprises that received grants were owned by females. There could be a more rigid selection as to who receives the grant among male owned enterprises than is applied to female owned enterprises. As a result, male owned enterprises perform better.

Concerning village characteristics, none of them is significantly different than zero at a 90 percent confidential level. Distance to the central of Yogyakarta city is statistically different than zero at an 85 percent confidential level. The further the village is from the central city of Yogyakarta, the slower its firms recover. This seems to be logical. One argument could be that various infrastructures in a village far from the city of Yogyakarta

might have experienced a slower pace of reconstruction and so affect the performance of enterprises in that village.

With regard to industrial characteristics, though not reported, four of the six parameters of the dummies for 1 digit ISIC code are significantly different than zero at a 95 percent confidential level; the other two at a 90 percent level. The cluster size of an industry within a subdistrict is significantly different than zero at a 90 percent confidential level (actually at a 96 percent confidential level). The positive sign of the parameter for the cluster size indicates that the greater the concentration of similar enterprises in a subdistrict, the faster these enterprises recover.

During the first six months, providing a promise to enterprises that they will receive some financial support significantly affects their recovery rate; i.e. there is an indication of an 'announcement effect' in this case. The expectation of receiving a grant does create either an incentive to wait till the grant is given or a disincentive to exerting greater effort to recover faster. Among those promised to receive a grant, actually receiving it does significantly improve their rate of recovery. Furthermore those receiving the grants within 3 months after the earthquake show superior performance.

The main message to donors is probably something like this. First, given the 'announcement effect' could be negative, it is probably better not to make promises to victims of a natural disaster but rather just supply the support unannounced when it is ready to be delivered. Second, it helps a great deal if the support arrives as soon as possible.

5.2. Within a Year (August 2007)

The general strategy in estimating the equation (12) using the data from the second firm-level survey is the same as that using the data from the first one. This time, the focus is only on firms that were surviving when the first firm-level survey was conducted (by February 2007). Descriptive statistics of variables involved can be seen in Table 4.

The Durbin-Wu-Hausman test this time also suggests that the OLS estimation is able to produce consistent and asymptotically efficient estimators. There is no need to conduct an IV estimation. Multicollinearity and omitting variable estimation bias do not seem to be a problem in the result of the OLS estimation. An expectation that there is a location correlation problem suggests that the error terms of the OLS estimation need to be clustered according to their subdistrict (*kecamatan*) location. An OLS-Cluster estimation is then conducted. Finally, due to the concern that there is a selection bias since several of the firms surviving in February 2007 decided to close down by August 2007, a Heckman-Cluster

estimation is applied to equation (12) using equation (13) as the censored equation. This time, the parameter lambda of the Inverse Mills ratios is very week. It is only significantly different than zero at a 42 percent confidential level. There is no need to utilise the results from the Heckman-Cluster estimation. Hence, it does not really matter if one utilises the results from OLS-Cluster or Heckman-Cluster estimations (model 3 or 4 in Table 5).

Table 4. Descriptive Statistics of Variables from the Second Survey

n = 299	Unit	Mean	Std. Dev.	Min	Max
Recovery rate	%	73.66	31.91	0	100
Firm Characteristics					
Firm size (# of workers)	person	7.62	12.17	1	101
Assets per worker	Rp. million	11.51	13.47	0.01	90
Living area of most worker (Bantul = 1)		0.94	0.23	0	1
Loan per worker	Rp. million	0.51	2.30	0	35.29
Market the product only to Yogyakarta (yes = 1)		0.71	0.45	0	1
# of years the firm has been established	year	17.50	13.11	1	80
Owner Characteristics					
Owner's gender (male = 1)		0.52	0.50	0	1
Owner's experience	year	19.71	12.08	2	60
Has other source of income (yes = 1)		0.24	0.43	0	1
Village Characteristics					
Distance to the centre of Yogyakarta city	km	16.40	8.86	2	40
Village head's age	year	44.92	9.11	29	66
Village head's education	year	4.85	1.01	3	7
Industrial Characteristics					
Size of 3 digit ISIC cluster in a sub-district		0.31	0.22	0.01	0.64
Aid Characteristics					
Grant	Rp million	3.50	4.80	0	30.0
Promise to receive grant (yes = 1)		0.52	0.50	0	1
Received grant in time (yes = 1) x Grant		0.24	1.25	0	10.26
Others					
Initial damage	%	90.31	26.46	0	100

Note: For education, 1=not finished elementary, 2=finished elementary, 3=finished secondary, 4=finished high, 5=finished 2 year diploma, 6=finished university and 7=finished post graduate

Table 5. Estimation Results for the Situation within a Year

Sale recovery rate is the independent variable	OLS (model 1)	IV (model 2)	OLS-Cluster (model 3)	Heckman-Cluster (model 4)
Firm Characteristics				
Firm size (# of workers)	-0.44***	-0.36	-0.44**	-0.43**
	(0.17)	(0.28)	(0.20)	(0.20)
Assets per worker	-0.31**	-0.32**	-0.31**	-0.32**
	(0.15)	(0.15)	(0.12)	(0.14)
Living area of most worker	3.91	3.93	3.91	4.45
(Bantul = 1)	(8.27)	(8.36)	(4.72)	(4.82)
Loan per worker	-0.14	0.07	-0.14	-0.16
	(0.81)	(0.99)	(0.54)	(0.55)
Market the product only to Yogyakarta (yes = 1)	-3.04	-3.78	-3.04	-2.86
	(4.55)	(5.01)	(4.47)	(4.75)
# of years the firm has been established	-0.08	-0.08	-0.08	-0.08
	(0.20)	(0.20)	(0.18)	(0.18)
Owner Characteristics				
Owner's gender (male = 1)	-2.11	-0.46	-2.11	-2.31
	(4.47)	(6.29)	(4.86)	(5.06)
Owner's experience	-0.29	-0.28	-0.29	-0.32
	(0.57)	(0.58)	(0.49)	(0.49)
Owner's experience-squared	0.01	0.01	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Has other source of income (yes = 1)	-0.34	-0.93	-0.34	-0.13
	(4.31)	(4.64)	(4.19)	(4.39)
Village Characteristics				
Distance to the centre of Yogyakarta city	-0.24	-0.27	-0.24	-0.24
	(0.26)	(0.28)	(0.22)	(0.22)
Village head's age	-0.09	-0.07	-0.09	-0.09
	(0.21)	(0.22)	(0.29)	(0.29)
Village head's education	2.52	2.90	2.52	2.57
	(1.93)	(2.19)	(2.12)	(2.10)
Industrial Characteristics				
Dummies of 1 digit ISIC	Included	Included	Included	Included
Size of 3 digit ISIC cluster in a sub-district	23.92**	26.58*	23.92**	23.62**
	(11.77)	(13.83)	(8.86)	(8.98)
Aid Characteristics				
Grant	-0.92*	0.30	-0.92*	-0.95*
	(0.49)	(3.28)	(0.45)	(0.45)
Promise to receive grant (yes = 1)	-0.13	-6.27	-0.13	-0.39
	(4.66)	(16.95)	(4.16)	(4.07)
Received grant in time (yes = 1) x Grant	0.61	0.27	0.61	0.59
	(1.49)	(1.76)	(0.86)	(0.86)
Others				
Initial damage	-0.12*	-0.13*	-0.12	-0.12
	(0.07)	(0.08)	(0.08)	(0.08)
Constant	107.71***	105.58***	107.71***	108.00***
	(22.27)	(23.21)	(23.98)	(24.14)
Lambda (Inverse Mills Ratio)				-3.33
				(7.96)
Number of Observation	298	298	298	298
R-Squared	0.15	0.13	0.15	0.15
Ramsey test (Prob > F)	0.72		0.72	
Durbin-Wu-Hausman (P-Value)		0.69		

Note: Numbers in bracket are standard deviations; *** is significant at 1%, ** is significant at 5% and * is significant at 10%

After a year, initial damage is no longer a significant variable in determining a firm's recovery rate. It is still weakly important though (with an 85 percent confidential level, it is different than zero) and the sign is still consistent with the situation within 6 months after the earthquake. Firm size is a significant variable determining the rate of recovery and the sign is negative; i.e. the smaller the firm, the faster it recovers. The loan per worker and number of years that the firm has been established are no longer a significant variable a year after the earthquake, but asset intensity measured by total assets per worker is. It is suggested that those with a higher asset per worker recover more slowly. This could indicate that firms still face difficulties in restoring their assets in order to recover faster.

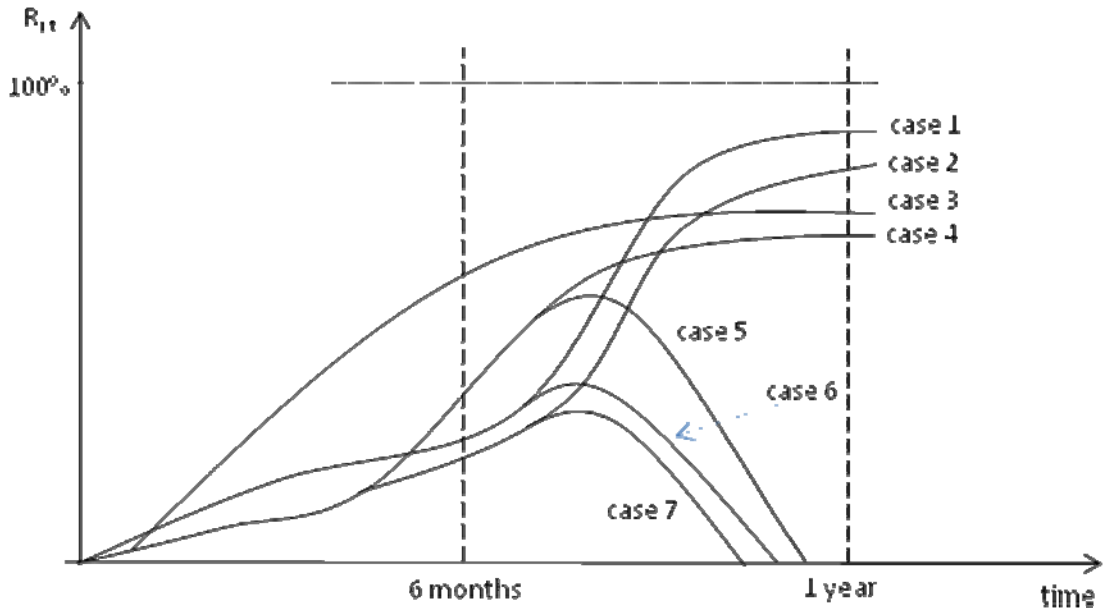
Regarding owner characteristics, owner gender is no longer an important variable. By now the proportion of firms under male ownership receiving grants has increased. This could be an indication that gender is not an issue in firm recovery. The quadratic term of owner experience is significantly different than zero with an 89 percent confidential level. Those with greater experience seem to recover faster.

All village characteristics are now no longer important. This could be because infrastructure reconstruction has been progressing well even in areas that are far from the city of Yogyakarta. Industrial characteristics are still important. Five of the six dummies representing the 1 digit ISIC parameters are important and the industrial cluster size in a subdistrict are significantly different than zero at a 95 percent confidential level, indicating their importance in determining a firms' recovery.

With regard to aid related variables, within a year the 'announcement effect' diminishes. After a while those who have not received the promised grants give up waiting and find their own way of recovering. A similar situation can also be argued regarding enterprises that are never promised a grant and do not receive any. These enterprises realise that they have to find their own way to survive. Some of those not able to find their own resources to survive have to close down (in Figure 3: 20 out of 134 enterprises). Those who have been successful, however, have done so very well. This is one of the reasons why the parameter for the grant is significantly negative. After a year the average recovery rate of this group is 75.5 percent, while the overall average for affected firms that survive is 73.7 percent. The other reason for the negative sign and the significance of the parameter for the grant is that the effectiveness of the grant does diminish over time.

Another important fact to take into account in discussing financial support for enterprises is that only 3 percent of enterprises receiving funds had to close down within a year of the earthquake; while 15 percent of enterprises that never received any support had to

close down. In a way, financial support did provide some kind of safety net for micro, small and medium enterprises. Figure 5 probably illustrates the trajectory paths of firm recovery, everything else being equal but for the condition related to the grant.



Note:
- Case 1: Firm never promised a grant, did not receive any, and survived.
- Case 2: Firm promised a grant, but did not receive any, and survived
- Case 3: Firm promised a grant, received it in time and survived
- Case 4: Firm promised a grant, received it but not in time, and survived
- Case 5: Case 4, but closed down
- Case 6: Case 1, but closed down
- Case 7: Case 2, but closed down

Figure 5. Trajectory Path to Recovery

6. Conclusion

This paper is an attempt to understand the determinants of micro, small and medium enterprise recovery after the 2006 Yogyakarta earthquake and the role of aid; in particular what firm characteristics are among the determinants of the micro, small and medium enterprise recovery rate; was receiving aid a significant determinant of the recovery rate, does promising to provide aid create an 'announcement affect' and, if it does, what is the effect on firm recovery rate; and was receiving aid in time an important factor?

Two firm-level surveys were conducted to gather information related to this issue in Bantul district 6 months and a year after the earthquake. There are two major weaknesses in these surveys. First, since prior information was not available as to how many micro, small

and medium enterprises there are in Bantul district and their exact location, it is difficult to generate a good quality sample frame. The community survey conducted for this paper does help, but information provided by the village office is not perfect. It could vary according to the quality of administration in those villages. Second, the number of samples taken during the surveys is rather small so that a village cluster or 3 or more ISIC digit dummy cannot be utilised in the model. Gathering enough funding within a short period of time was the main constraint. This fact does lower the quality of the econometric analysis in this paper.

Taking these weaknesses into account, several conclusions can be drawn from the analysis of this paper. The first group of conclusions is related to initial damage, firm, owner and industrial characteristics. First, the initial damage level is a determinant of a firm's recovery. Not much can be done about this, since how much damage occurs is a random process. Second, there is a virtue in keeping the size of the enterprise smaller in terms of workers or assets per worker. Smaller enterprises turn out to be more resilient to natural disaster impacts; i.e. smaller enterprises bounce back faster. Third, owner and village characteristics, though they may be important, are not always so. The analysis in this paper indicates that firms' recovery rate depends on the quality of some facilities available in the area where the firms are located. Fourth, the idea of clustering a certain type of industry in the same location is not a bad idea. It does provide the support needed by firms to recover.

The second group of conclusions is related to aid provided to enterprises. For a relatively short period after the earthquake, it is probably better not to make too many promises of financial support to enterprises, but rather just to distribute it when it is actually available. The faster it is distributed, the better the impact on enterprises affected by the earthquake. Over a longer period of time, the effectiveness of aid in accelerating the pace of a firm's recovery might well diminish. However, providing financial support does improve a firm's ability to survive.

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