



Financial shocks, bankruptcy, and natural selection[☆]



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ABSTRACT

In this paper, we investigate whether financial shocks to firms affect their probability of bankruptcy. We also examine whether these shocks affect the natural selection of the firms, whereby more efficient firms are less likely to go bankrupt. By using the data on the bankruptcy of firms after the Great Tohoku Earthquake, we examine the impact of the damage to lender banks on the firms' probability of bankruptcy. To extract the impact of purely exogenous financial shocks on bankruptcy, we focus on firms located *outside* the earthquake-affected area but that transact with banks located *inside* the area. Our findings somewhat counterintuitively suggest that a damaged bank *reduces* the probability of bankruptcy and *weakens* the natural selection of firms. We further examine the impact of the injection of public capital into damaged banks and obtain some evidence that the injection reduces the probability of the bankruptcy of their borrowers and weakens the natural selection.

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1. Introduction

Do financial shocks affect the real activities of the corporate sector in an economy? Numerous studies have tried to answer this question by focusing on the adverse shocks transmitted by the banks that the firms transact with. This focus reflects the fact that for many firms, especially small- and medium-sized enterprises (SMEs), one of their key sources of finance is loans from banks. Such studies investigate whether the shocks from these banks have a real impact on the different aspects of corporate activities, for example, capital investment (Hosono et al., 2016; Amiti and Weinstein, 2013), exports (Amiti and Weinstein, 2011; Miyakawa et al., 2014; Paravisini et al., 2014), and construction activities (Peek and Rosengren, 2000). In this paper, we focus on the impact of the financial shocks on an important aspect of a firm's dynamics: bankruptcy.

The major challenge to this examination is how to overcome the endogeneity problem. While the shock to banks could adversely affect the real activities of the borrowing firms, the poor performance of the borrowers could also adversely affect the performance of the banks. Thus, it is difficult to empirically identify the direction of the causality. There are some approaches to address this

problem. We follow the approach that takes advantage of a financial shock that is purely exogenous to the firms. To be precise, we use the data on the bankruptcy of firms after the Great Tohoku Earthquake (also known as the Great East-Japan Earthquake) that hit the Tohoku area of Japan on March 11, 2011.¹ We focus on the impact of the damage that the firms' main banks suffered from the earthquake. Because main banks are the primary source of finance for SMEs in Japan, damage to them can cause a serious financial shock to the borrowers.

Although we can naturally expect that the damage to the banks has an adverse impact on the banks' lending capacity, the poor performance (in our case, bankruptcy) of the firms located inside the affected area might reflect their own damage from the earthquake as well. To alleviate this problem, we use the data on SMEs that are located *outside* the earthquake-affected area to extract a purely exogenous shock from the financial frictions with the damaged banks.² We examine the differences in their probability of bankruptcy based on whether their banks did or did not suffer damages from the earthquake. To represent a bank's damage, we use two proxies: the location of the banks' headquarters inside the affected area and the share of their branch offices inside the affected area.

In addition to this investigation, we are also interested in whether and how the financial shock changes the natural selection of the firms, that is, the mechanism through which the market eliminates inefficient firms (e.g., Bertin et al., 1996; Bresnahan and Raff, 1991; Caballero and Hammour, 1994, 1996, 2005). While the evidence in the literature suggests that natural selection indeed works after the Great Tohoku Earthquake both inside and outside the affected area (e.g., Uchida et al., 2014), this paper does not examine the effect of damaged banks on the probability of bankruptcy or the natural selection of the banks' borrowers.

From our analysis, we consistently find that our proxies for the banks' damage have negative and statistically significant coefficients. This finding implies that the damage to the main bank *decreases* the bankruptcy probability of its borrowing firms, which is inconsistent with the prediction that financial shocks from damaged banks have a positive impact on the probability of a firm's bankruptcy. Further, we also find that as our measure of firm efficiency increases, the probability of bankruptcy decreases both for the firms transacting with damaged main banks and for those transacting with undamaged ones. This finding supports the natural selection. However, we find that the natural selection is weakened, in a relative sense, when the main bank is damaged; that is, the sensitivity of the probability of bankruptcy with respect to firm efficiency is smaller for firms transacting with damaged main banks than for those transacting with undamaged ones.

Because the finding of the decreased probability of bankruptcy for (less efficient) firms is somewhat counterintuitive, we further examine a potential underlying mechanism through which damaged banks reduce the bankruptcies of their borrowers. One of the possible factors that could explain our finding is the presence of many policy measures that targeted the banks in the affected area. Most importantly, the damaged banks that obtained a public capital injection from the government of Japan might have been able to increase their lending capacity, lend to (even less efficient) borrowers, and promote survival of the borrowers. To examine this hypothesis, we compare the bankruptcies of borrowers of damaged

banks depending on whether the banks obtained an injection of public capital. Both the univariate and multivariate analyses show some evidence that the probability of bankruptcy is indeed smaller for the borrowers of damaged banks that obtained the public capital injection, especially when the borrowers were less efficient.

This paper contributes to two different strands of the literature. First, as indicated at the outset, this paper is related to the literature on the effect of financial shocks on the real activities of firms. Among the many studies, the closest to ours examine the impact of financial shocks inflicted by an exogenous change in the economic conditions for bankruptcy or loan default (Khawaja and Mian, 2008; Schnabl, 2012). Our paper differs from these papers in that we take advantage of a shock created by a natural disaster and in that we also focus on natural selection.

Second, this paper is also related to the studies on the impact of natural disasters on economic activities. There are many studies on this impact on economic growth, and some studies even report a *positive* impact on the productivity of the economy's corporate sector (e.g., Skidmore and Toya, 2002; Crespo Cuaresma et al., 2008). There are also a few studies that focus on the impact of a natural disaster on a firm's recovery afterwards (Leiter et al., 2009; De Mel et al., 2011), its supply chain networks and its recovery (Todo et al., 2015; Carvalho et al., 2014), its relocation (Ono et al., 2014; Siodla, 2013), and on its bankruptcy (Cole et al., 2013; Uchida et al., 2014). The present paper is different from these studies because we do not focus on damaged firms but on undamaged firms (i.e., those located outside the affected area) to extract a purely exogenous financial shock from the damaged banks.³

The remaining part of this paper is comprised of the following. The next section explains the data and empirical method. Section 3 reports the results. In Section 4, we extend the analysis by taking into account the effect of a public capital injection on the banks. The final section concludes the paper.

2. Data and empirical method

2.1. Data and sample selection

We obtain the firm-level data that comprises the information on bankruptcies, characteristics, and their banks from the Teikoku Databank Ltd. (TDB), which is one of the top business credit information bureaus in Japan. From this data set, we select the firms whose headquarters were located in the six prefectures of the Tohoku area of Japan (Aomori, Iwate, Miyagi, Akita, Yamagata, and Fukushima) when the Great Tohoku Earthquake hit the region. We do not use firms outside these six prefectures because most of our sample firms are SMEs and are not likely to borrow at a distance from the damaged banks in these prefectures. Further, using firms outside of this area could increase the region-specific differences among the sample firms.

Within the six prefectures, we have information on the bankruptcy status of 98,070 firms during the post-earthquake period of March 2011 to November 2012. Of the six prefectures, some areas were seriously damaged by the earthquake, but many other parts were not severely damaged. This is because the direct damage from the earthquake was not severe. The serious damage was mostly due to the tsunamis in the coastal area that faces the

¹ There were 27,154 casualties (18,131 dead, 282e9 missing, and 6194 injured) due to this earthquake, the accompanying tsunami, and the accident at the nuclear plant in Fukushima (Fire and Disaster Management Agency of the Government of Japan: <http://www.fdma.go.jp/bn/higaihou/pdf/jjishin/146.pdf> (in Japanese)).

² We thus rely on geographical information as a proxy for the firms' damage, because no firm-level information on their damage is available.

³ Similar to the present paper, using data after the Hanshi-Awaji Earthquake in Japan, Hosono et al. (2016) and Miyakawa et al. (2014) examine the capital investments and exports of undamaged firms transacting with damaged or undamaged banks (as well as those of damaged firms). They find evidence for a negative effect of financial shocks. Also, Berg and Schrader (2012) examine the effect of a volcanic eruption in Ecuador and find a smaller approval rate for microfinance after the eruption.

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