Banking crisis and productivity of borrowing firms: Evidence from Japan

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ABSTRACT

We investigate the effects of bank distress on the productivity of borrowing firms by using data on listed companies in the Japanese manufacturing industry during the 1990s. We find that deterioration in the financial health of banks, which is measured by a decline in the capital-asset ratio, decreased the productivity of their borrowers during the period of the severe financial crisis (FY1997–1998). Our finding empirically confirms the theoretical view that an increase in financial friction negatively affects the productivity of the corporate sector.

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1. Introduction

This paper attempts to clarify the effects of bank distress on the productivity of borrowing firms by using data on listed companies in the Japanese manufacturing industry during the 1990s. Many empirical studies conclude that deterioration in the financial health of Japanese banks had adverse effects on the investment of their borrowers during the 1990s (Gibson, 1995, 1997; Kang and Stulz, 2000; Nagahata and Sekine, 2005; Fukuda et al., 2005, 2006).

However, there is no consensus on whether the productivity of firms was affected by deterioration in the financial health of banks. Ogawa (2007) reports that nonperforming loans at banks had no effects on firms' investments in research and development that were closely related to the productivity growth of firms. In contrast, Fukuda et al. (2008) report that the productivity of firms declined when unhealthy banks extended long-term loans to the firms. These previous studies encounter common difficulties in dealing with the endogeneity problem related to the financial health of banks: The health of banks is likely to be affected by the productivity of firms. Our study, which solves the endogeneity problem by using valid instruments for bank health, sheds light on

the unexplored relationship between the financial health of banks and the productivity of their borrowers.[1]

Our study is closely related to the studies on the causes of the long stagnation in the Japanese economy during the 1990s. Many researchers argue that a prolonged decline in the total factor productivity (TFP) growth resulted in economic slowdown after the collapse of the asset price bubble (Hayashi and Prescott, 2002; Kobayashi and Inaba, 2005).[2] The decline in the TFP growth may be partly attributed to the distress in the banking sector. This paper attempts to examine whether the bank distress caused the decline in the productivity in the Japanese economy during the 1990s.

We find that a decline in the capital-asset ratio of a bank decreased the productivity of borrowers during the severe

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[1] Some studies examine the effects of bank distress on the (expected) profitability of the borrowers, using the event study framework. These studies investigate changes in the stock prices of borrowing firms surrounding the day of an event such as the announcement of a bank failure. Slovin et al. (1993) examine the failure of the Continental Illinois Bank, while Yamori and Murakami (1999), Kang and Stulz (2000) and Miyajima and Yafeh (2003) examine the cases of bank distress in Japan during the 1990s. Our study is different from these studies in that we directly estimate the changes in the productivity of borrowers when the financial health of banks deteriorated.

[2] Kawamoto (2005) finds no evidence of a decline in the true technological progress for the Japanese economy during the 1990s, controlling for capital utilization and reallocation of inputs.

financial crisis (FY1997–1998). Many researchers point out that a credit crunch occurred during this period (Woo, 2003; Watanabe, 2007). Our finding suggests that a banking crisis had adverse effects on the productivity of firms through a credit crunch. Kobayashi et al. (2007) and Chari et al. (2007) provide a theoretical explanation for why a credit crunch can cause deterioration in the productivity of firms. They argue that the productivity of firms can decline because of distortions in the production process when financing for an intermediate input is constrained. Our finding is consistent with their views.

This paper is organized as follows. In Section 2, we briefly describe Japan's banking crisis during the 1990s. Section 3 presents the methodology of our empirical study. Section 4 presents our finding that deterioration in the financial conditions of banks, which is measured by a decline in the capital-asset ratio, decreased the productivity of their borrowers. Section 5 presents the robustness checks of our results. Section 6 discusses the causes of the decline in productivity. Section 7 presents our conclusions.

2. Banking crisis in Japan

In this section, we present an overview of the banking crisis in Japan.[3] Japanese banks aggressively increased their lending to real estate-related industries in the late 1980s, when land prices soared. The collapse of the land price boom in 1991 turned many real estate loans into nonperforming ones. However, the banks, anticipating a quick recovery of land prices, were reluctant to write off the nonperforming loans and continued to support their distressed borrowers. Contrary to their expectation, land prices consistently fell during the 1990s. As a result, huge loan losses undermined the financial health of banks. The bank distress culminated in a widespread liquidity crisis in late 1997.[4]

In November 1997, the bankruptcy of Sanyo Securities resulted in the first postwar default in the interbank market. The default precipitated a sharp contraction in the interbank market, and many financial institutions suffered a liquidity crunch. Two major financial institutions, namely, Hokkaido Takushoku Bank and Yamaichi Securities, failed during the liquidity crisis. The turmoil in the banking sector was not over although the government injected 1.8 trillion yen into 8 major and three regional banks in March 1998. Two major banks, namely, the Long-Term Credit Bank and Nippon Credit Bank, failed in late 1998. The government once again injected 7.5 trillion yen into 15 major banks in March 1999. Finally, the banking crisis ended by early 2000 because of the recapitalization by the government and the announcement of consolidation among major banks.

After the crisis, there was steady progress in bank consolidation and the disposal of nonperforming loans. The ten city banks operating as of 1997 were reorganized into five groups by early 2005. The nonperforming loans of major banks, which had reached 26.8 trillion yen in March 2002, were reduced to 7.4 trillion yen by March 2005.[5] In April 2005, the Japanese financial system became normal for the first time in 15 years, when the government declared an end to the problem of the nonperforming loans.

3. Empirical methodology

3.1. Data

We study the effects of bank health on the level of the productivity of manufacturing firms during the 1990s. Specifically, we examine the manufacturing firms listed on any of the three major stock exchanges in Japan (Tokyo, Osaka, and Nagoya) for FY1993–2002. A fiscal year runs from April to March. There were more than 1300 listed manufacturing firms during the sample period.

We use the TFP as a measure for the productivity of firms.[6] Following the approach of Good et al. (1999) and Fukao and Kwon (2006), we construct a hypothetical representative firm for the entire manufacturing industry in each year.[7] The TFP level of every firm in each fiscal year is measured relative to that of the hypothetical firm in FY1990. The TFP level of a firm i in year t relative to that of a hypothetical firm in year 0 (the base year) is calculated as follows:

$$\ln TFP_{it} = (\ln Y_{it} - \overline{\ln Y_t}) - \sum_{k}^{n} \frac{1}{2}(S_{k,it} + \overline{S_{k,t}})(\ln X_{k,it} - \overline{\ln X_{k,t}})$$
$$+ \sum_{s=1}^{t}(\overline{\ln Y_s} - \overline{\ln Y_{s-1}}) - \sum_{s=1}^{t}\sum_{k=1}^{n}\frac{1}{2}(\overline{S_{k,s}} + \overline{S_{k,s-1}})(\overline{\ln X_{k,s}}$$
$$- \overline{\ln X_{k,s-1}}), \tag{1}$$

where $\ln Y_{it}$ is the logarithm of the output of firm i in year t, $S_{k,it}$ is the cost share of the input k of firm i in year t, and $\ln X_{k,it}$ is the logarithm of the input k of firm i in year t. $\overline{\ln Y_t}$, $\overline{S_{k,t}}$, and $\overline{\ln X_{k,t}}$ denote the averages of $\ln Y_{it}$, $S_{k,it}$, and $\ln X_{k,it}$, respectively, across all the manufacturing firms in year t. We assume a hypothetical manufacturing firm with $\overline{\ln Y_t}$, $\overline{S_{k,t}}$, and $\overline{\ln X_{k,t}}$ in year t. Thus, in Eq. (1), the first two terms describe the difference between firm i and the hypothetical firm in year t, while the last two terms chain together the hypothetical firms back to the base year. The output of a firm is the total sales. The inputs of a firm are intermediate input, labor, and capital.[8] The changes in working hours and capital utilization can affect the estimation of the productivity of firms. Unfortunately, we cannot obtain firm-level data on working hours and capital utilization. We partially control for the effects of these factors by using sector-level data.

We focus on the relationship between firms and their main banks because many researchers argue that main banks play a special role in the case of Japanese firms (Aoki and Patrick, 1994). However, identifying a main bank for each firm is not an easy task, because there is no rigid definition of a main bank. Following Gibson (1995) and Hori et al. (2004), we identify a main bank for each firm based on *Kaisha Shikiho* (Japan Company Handbook), published by Toyo Keizai.[9] The handbook lists the names of banks that each firm deals with. The first bank in the list is identified as the main bank for the firm. If a governmental financial institution is

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[3] See Miyajima and Yafeh (2003) for a detailed chronology of the banking crisis in Japan.

[4] Hoshi and Kashyap (2001: 276–80) provide a detailed description of the banking crisis in the late 1990s.

[5] The data of nonperforming loans are based on the Financial Reconstruction Law. The data are available from the Web site of the Financial Services Agency. The Financial Services Agency. "Status of Non-Performing Loans." http://www.fsa.go.jp/en/regulated/npl/index.html (accessed March 15, 2008).

[6] We calculate the TFP using the index number approach. The Solow residual is included as a special case of the index number approach. The estimation of the Solow residual usually necessitates strong assumptions such as marginal cost pricing and constant returns. See Bartelsman and Doms (2000) for details.

[7] We classify the manufacturing industry into 17 sectors. However, we do not construct a representative firm for each sector in order to compare the productivity of firms across sectors. The 17 sectors consist of foods, textile products, wooden products, pulp and paper products, publication and printing, chemical products, petroleum refinery, rubber products, ceramic, stone and clay products, iron and steel, non-ferrous metals, metal products, general machinery, electrical machinery, transportation equipment, precision instruments, and miscellaneous manufacturing products.

[8] In calculating the TFP, our sample excludes observations for which data on cost share of inputs are unavailable. We also exclude observations with capital-labor ratios in the top or bottom 1 percent in the total observations during FY1990–2002.

[9] We refer to the summer issue of *Kaisha Shikiho* for the construction of data.