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TSURUTA, Daisuke
Nihon University

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Lack of Successors, Firm Default, and the Performance of Small Businesses[†]

Daisuke Tsuruta[+]
College of Economics, Nihon University

Abstract

We investigate the effects of the lack of successors on small businesses with an elderly manager. Using firm-level data from Japan, which is a country with an ageing population, we find the following results.

First, smaller, younger, highly leveraged, and non-growing firms are likely to have no successor. Second, firms with an elderly manager are more likely to exit and default if they have no successors, and this was particularly the case during the period of the global financial crisis around 2009. This result suggests that these firms have less incentive to repay debts because they are not going concerns. As a result of the high probability of default and exit, the annual rate of change in bank borrowing is low if firms with an elderly manager have no successor. Third, using the propensity score matching method, we find that sales growth for firms with no successor is lower than that for other firms.

Keywords: successor, small business, elderly manager, firm default, firm performance
JEL classification: G32; L25; M12; M21

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[+] Address.: 1-3-2 Kanda Misaki-cho, Chiyoda-ku, Tokyo 102-8360, Japan.;Tel.: +81-3-3219-3606.; E-mail address: tsuruta.daisuke@nihon-u.ac.jp

1 Introduction

We investigate the empirical relationships between the lack of a successor for a small business manager and firm default, borrowing and performance using firm-level data from Japan. Japan is an ageing country. Indeed, many developed countries have increasingly elderly populations. In line with the increasing age profile, small business managers in Japan are becoming older. The average age of a small business manager in 2009 was 59.57 years, but by 2018, it was 61.73.[1] According to the *2017 White Paper on Small and Medium Enterprises in Japan* by the Small and Medium Enterprise Agency, small business managers retire around 68 or 69 years of age on average. As small business managers get older (over 60), they need to consider the succession of their firms in the near future. Many small businesses face difficulties in finding successors and are unable to replace their elderly manager with a younger manager.

Many studies (e.g., Bertrand and Schoar, 2006) illustrate the importance of the succession of a manager in the life cycle of a firm. The manager's ability has a particularly large effect in the case of small firms. Thus, the succession of small business managers has a significant impact on the activities and performance of small businesses. Many previous studies (e.g., Kaplan and Minton, 1994; Kang and Shivdasani, 1995) investigated the determinants of the turnover of CEOs in listed firms and showed a relationship between CEO turnover and firm performance. Some studies focused on family businesses and investigate the performance of firms after the succession and turnover of a manager (Smith and Amoako-Adu, 1999; Huson et al., 2004; Péz-González, 2006; Bennedsen et al., 2007; Chung and Luo, 2013). Saito (2008) and Mehrotra et al. (2013) investigated the heterogeneous effects of succession using data on Japanese listed firms, divided by the types of descendant. Using a sample of listed firms, Tao and Zhao (2019) showed that firms with relay succession enjoy higher profitability and stock returns and lower volatil-

[1] See the Tokyo Shoko Research website (http://www.tsr-net.co.jp/news/analysis/20190214_01.html and http://www.tsr-net.co.jp/news/analysis/20141002_01.html) (in Japanese, last accessed March 2019)

ity after turnover. Focusing on small businesses, Diwisch et al. (2009) and Uesugi and Saito (2009) investigated the effects of succession on firm performance and growth using firm-level data. Diwisch et al. (2009) focused not only on the effects of actual succession, but also on the effects of succession plans on firm growth.

In this paper, we focus on whether a successor has been appointed prior to the actual succession in small businesses with an elderly manager. We investigate the effects of the existence or lack of a successor while the firm still has an elderly manager, rather than the effects of the actual succession. This research question is important in relation to small businesses. According to the World Bank, the proportion of the population aged 65 years and above in Japan is 27.05%, whereas in the OECD countries, it is 16.81%.[2] These percentages are increasing in Japan and the OECD countries. We predict that more-developed countries will face the situation of increasingly older small business managers currently experienced in Japan. Therefore, the effects of the lack of a successor on small business management is expected to become an important issue in many countries. As Japan is the most rapidly ageing country, we can investigate this issue by utilizing the large amount of available data on small businesses with an elderly manager.

Even when an elderly manager remains in his/her position, the lack of a successor may have effects on the firm's default probability, borrowing and performance. First, the lack of a successor has significant effects on the financial activities of small businesses with an elderly manager. The information asymmetry between small business borrowers and banks is a serious issue that impedes small business lending. Small businesses have an incentive to choose risky projects, which are not preferred by banks, and the information problems of moral hazard and adverse selection result in an insufficient credit supply and credit rationing. According to Petersen and Rajan (1994), close lending relationships between banks and small business borrowers enable the borrowers to transfer information to the banks. Thus, the information gap is mitigated by the establishment of lending

[2]See the World Bank website, https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS (Last accessed March 2019)

relationships.

As Bolton and Scharfstein (1990) argued, the threat that borrower–lender relationships will end mitigates the moral hazard problem in the case of small businesses. Borrowers do not select risky investments because the banks will not offer credit to defaulting firms. If they terminate their relationships with banks, small businesses cannot obtain sufficient funds, even when they have profitable investment opportunities. Furthermore, borrowers make efforts to repay debts to avoid the termination of their lending relationship. However, if there is a high probability that a firm will exit from a market because it lacks a successor for its elderly manager, then the threat of termination of the bank–borrower relationship will not be sufficient to prevent moral hazard. We predict that the lack of a successor will have significant positive effects on exit from the market, in the sense that it will significantly increase the probability of a firm exiting from the market. The lack of a successor also has significant positive effects on the probability of default because these firms have less incentive to repay debts, which causes a moral hazard problem. In addition, as credit risk is high for firms with no successors, banks reduce credit supply to these firms. However, it could be argued that firms with no successors repay a large amount of debt to exit from the market smoothly, which means that their probability of default is lower even if the probability of exit is higher.

Second, the relationships between firm performance and the lack of a successor can be negative. If the credit constraint caused by the lack of a successor is severe, firms without successors cannot finance investment opportunities, even if they have projects with positive net present values. This suggests that the level of investment is lower for firms with no successor. Additionally, if there are no successors, the probability that these small firms will exit the market is high. In this case, there can be significant "shadow of death" effects. Griliches and Regev (1995) used this term to describe the effects of impending exit on the performance of firms. He found that the performance of firms that will exit from a market in the future is lower in the year before their exit compared

with the performance of surviving firms.[3] Therefore, we predict that the performance and growth of firms without a successor are lower than those of firms with a successor if credit constraints and shadow of death effects are severe.

As we have noted above, many existing studies investigated the effects of actual succession, but few investigated the effects of whether a successor exists prior to succession on small businesses. Further, many of the existing studies focused only on the effects on firm performance, whereas we include the effects on financial activities and default, which are not adequately investigated in the literature.

Using data involving almost 1 million observations of small businesses with elderly managers (aged 60 years and over) in Japan, we find the following results. First, smaller, younger, highly leveraged, and non-growing firms are likely to have no successor. This implies that financially and economically distressed firms are less likely to have a successor. Second, the probabilities of exit and default are higher for firms with no successor than for firms with a successor after controlling for proxies of firm risk and characteristics, and year, industry and region effects. These effects are larger during the global financial crisis around 2009. These results imply that firms with no successor have less incentive to avoid firm exit and default, especially during such an adverse shock. As these firms are not going concerns, the probability of repaying debts is low.

Third, the annual change of bank borrowing is lower for firms with no successor during the shock and post-shock periods (from 2007 onwards). The estimated results for default suggest that firms with no successor are more likely to default, and that they are riskier firms than those with a successor. Therefore, banks reduce lending to these firms because of their high risk. These results are supported if we use a propensity score matching method to conduct the estimations. Fourth, using a propensity score matching method,

[3]Griliches and Regev (1995) used data on Israeli industrial firms to show that future market exit has negative effects on firms' productivity. Almus (2004) focused on firm size and showed that firm growth is significantly lower if firms exit in the future. In addition, many previous studies (for example Carreira and Teixeira, 2011; Blanchard et al., 2014; Koski and Pajarinen, 2015) support the shadow of death hypothesis.

we show that the sales growth of firms with an elderly manager is lower if they have no successor. These effects are larger during the shock period, which supports the hypothesis that firms with no successor are lower performing than other firms.

The remainder of the paper is organized as follows. Section 2 describes the dataset. We present the estimation results for the determinants of the existence or lack of a successor in section 3. In addition, we introduce our empirical strategy for estimating the effects of the existence or lack of a successor and discuss the estimation results in section 4. Section 5 concludes the paper.

2 Data

We use firm-level data on small businesses from the Credit Risk Database (CRD) for small and medium enterprises (SMEs) established by several financial institutions and credit guarantee corporations under the guidance of the Small and Medium Enterprise Agency.[4] The data-collection process targets firms defined as small and medium enterprises (SMEs) under the Small and Medium Enterprise Basic Law.[5] The CRD uses data on the small business clients of financial institutions with regular member status, which have a duty to provide all of their small business client data in return for the CRD's credit risk scoring service, statistical information and other services. The data include clients' financial statements, firm default, manager age (based on four categories: 59 years or younger, 60–69 years, 70–79 years and 80 years or older) and information about the existence or lack of a successor. We omit observations if information about the existence or lack of a successor is not available. If these financial institutions cease transactions with a client firm, subsequent client data are not collected. Therefore, the data on high credit-risk

[4]The data are managed by the CRD Association. See http://www.crd-office.net/CRD/en/index.html (last date accessed: March 2019) for information about the CRD.

[5]According to the *White Paper on Small and Medium Enterprises in Japan* by the Small and Medium Enterprise Agency, "[U]nder the Small and Medium Enterprise Basic Law, the term 'SMEs' generally refers to enterprises with capital stock under 300 million yen and/or 300 or fewer regular employees, and sole proprietorships with 300 or fewer employees."

firms are more likely to be truncated because banks often cease transactions with risky firms. Furthermore, firm data start to accumulate only after bank transactions begin; therefore, many young firms that have no such transactions may be excluded from the database.

The dataset used in this study includes only corporations that have existed for more than 3 consecutive years in the CRD because we use lagged variables. We limit our investigation to firms with managers aged 60 years and over. We use observations from 2003 to 2014 because of data availability. Furthermore, some variables used in the econometric analysis include outliers; therefore, the data are truncated at their 0.5th percentiles and/or 99.5th percentiles in the sample. The data collected on 335,995 firms include information from their balance sheets and profit and loss statements. The number of full firm-year observations is 991,098. In terms of employee numbers, the firms in the first quartile have two employees, the median is four and the firms in the third quartile have 10 employees. The distribution of employees suggests that the CRD data include many micro firms, which are typically more informationally opaque. The 99th percentile of employees is 101, which indicates that our sample includes some larger small businesses.

Table 1 shows the ratio of the number of firms with no successor to the total number of firms, divided by year and the current manager's age. Focusing on the firms with managers aged 60–69 years, the ratio of firms with no successor is 0.3950, indicating that about 40% of firms with a manager aged between 60–69 do not have a successor. The ratios are lower for older managers, 0.2730 and 0.1965 for managers aged 70–79 or 80 and over, respectively. Focusing on the trend over 2003–2014, the full period of the study, we can see that the ratio of firms with no successor increases, especially in the 60–69 group. For example, the ratios increase from 0.3489 in 2003 to 0.4177 in 2007. However, these ratios fall to around 0.38 between 2008 to 2010. As we show in subsection 4.2.2, many firms with no successor exit and default between 2008 to 2010; thus, the ratios of firms with no successor decrease. After 2011, the ratios of firms with no successor increases

again. In 2015, the ratio increases to 0.4264. If we focus on the group with managers aged 70–79, we observe a similar trend to that for the group with managers aged 60–69. However, in the group with managers aged 80 years and over, the trend is ambiguous. In sum, we conclude that the number of firms with no successor increases as the age profile of the population increases.

3 Determinants of the Lack of a Successor

3.1 Equation

In this section, we estimate the determinants of the lack of a successor using the following model.

$$\begin{aligned} Pr(NoSuccessor_{i,t}=1) &= \Phi(\beta_1 Firm\ size_{i,t} + \beta_2 Firm\ age_{i,t} + \beta_3 Leverage_{i,t} \\ &+ \beta_4 ROA_{i,t} + \beta_5 Sales\ growth + \beta_6 Cash\ holdings_{i,t} \\ &+ \beta_7 Interest\ rate_{i,t} + \beta_8 Current\ assets_{i,t} + \beta_9 Manager\ age\ dummies \\ &+ \iota_t + \kappa_i + \lambda_i) \end{aligned} \tag{1}$$

where i indicates firm i, t indicates year t, ι_t is the year fixed effects from 2003 to 2014, κ_i is the industry fixed effects for 16 industries[6] and λ_i is the regional fixed effects for six areas.[7] $No\ Successor_{i,t}$ is a dummy variable equal to one if the successor has not been identified. Φ is the cumulative distribution function of the standard normal distribution. We limit the sample to firms with managers aged 60 years and older in year t.

Firm size is the natural logarithm of total assets in year t. Firm age is the natural logarithm of firm age in year t. Return on assets (ROA) is defined as the ratio of a

[6]The industry fixed effects are controlled by 15 industry dummies. The benchmark industry is agriculture and forestry.

[7]We specify the Hokkaido–Tohoku area as the reference area.

firm's operating income to total assets in year t. Sales growth is defined as the annual change in firm sales [ln(1+sales in year t) – ln(1+sales in year t–1)]. If low-performing small businesses face difficulties in finding a successor, the coefficients of ROA and sales growth are negative. We define leverage as the book value of debt divided by the book value of assets in year t. If financially distressed firms are unlikely to find a successor, the coefficient of leverage is negative. Furthermore, we predict that cash-rich firms can easily find a successor. If these statements are true, the coefficients of cash holdings are positive. Cash holdings are defined as the ratio of cash holdings to total assets in year t. The interest rate is defined as the ratio of a firm's interest expenses to the sum of its short- and long-term debt and discounted notes receivable in year t. Firms with a high interest rate are regarded as risky. Current assets are defined as the ratio of liquid assets minus cash holdings to total assets in year t. Similar to the prediction regarding leverage, these firms are likely to face difficulties in finding a successor; thus, we predict that the coefficients of the interest rate will be negative. We also control for current manager age by including two types of dummies: a 70–79 age dummy equals one if the current manager's age is between 70 and 79 years, and an 80-and-over age dummy equals one if the current manager's age is 80 years or more.

3.2 Estimation Results

Table 2 shows the summary statistics of each variable used in the econometric analysis. This table shows that the minimum and maximum values of each variable are not extremely high, and that the mean and median values are not greatly different, which suggests that the issues of outliers are not severe.

Table 3 provides the estimation results of equation (1). Column (1) shows the estimation results using all observations. The estimated coefficients of firm size and age are negative and statistically significant at the 1% level. This suggests that smaller and younger firms cannot easily find a successor. The estimated coefficient of leverage is posi-

tive and statistically significant at the 1% level. Highly leveraged firms and firms that pay high interest are regarded as financially distressed or risky; therefore, they are unlikely to find a successor. The estimated coefficient of ROA is positive and statistically significant at the 1% level, suggesting that unprofitable firms are likely to appoint a successor. By contrast, the estimated coefficient of sales growth is negative and statistically significant, suggesting that growing firms are likely to appoint a successor. The 70–79 and 80-and-over age dummies are both negative and statistically significant at the 1% level. Firms with an elderly manager are likely to appoint a successor because the current manager will retire in the near future.

Columns (2)–(4) show the estimation results of equation (1). Column (2) contains observations for the pre-shock period (2003–2006), column (3) describes the shock period (2007–2009), and column (4) describes the post-shock period (2010–2014). Although the estimation coefficients of some explanatory variables are not similar for the three periods, the estimation coefficients of firm size, firm age, leverage, the interest rate, cash holdings, sales growth, current assets and manager age dummies are similar. In addition, the magnitude of the estimated coefficients of the 70–79 and 80-and-over age dummies are larger for 2010–2014. As noted above, the average manager age has increased in recent years. At the same time, older managers are more likely to appoint a successor.

4 Effects of the Lack of a Successor

4.1 Hypothesis

In this paper, we test the following hypotheses using small business data. First, we investigate the effects of the lack of a successor on a firm exiting from the market and defaulting on payment of bank loans. Firms with an elderly manager are unlikely to continue to operate in the future if there are no successors. Therefore, we predict that the probability of exit is higher for small businesses with no successors. They do not

face large losses if their lending relationships with banks cease. Therefore, these firms have less incentive to repay their debt. If this is true, the probability of default is higher for small businesses with no successors. These effects will be larger during an adverse shock period because the firms must make greater efforts to repay their debt. Therefore, during a period when there is an adverse shock, we predict that the lack of a successor will result in a large probability of default. However, if firms with no successors would like to exit smoothly, they will repay a large amount of debt before exit. If this is true, the probability of default is lower even though the probability of exit is higher.

Second, we predict that the lack of a successor will have negative effects on firms' borrowing. As described above, firms with an elderly manager have less incentive to repay debts. If this is true, the credit risk of these firms is higher than is the case for the firms with a successor, which would result in a lower supply of loans to firms without successors. We predict that the amount of bank borrowing will be lower for firms with an elderly manager that lack a successor. In addition, the interest rate level will be higher compared with that offered to other firms because of the high credit risk of these firms. On the one hand, banks have no incentive to offer a lower interest rate and increase lending during an adverse shock, allowing the firms to repay them when economic conditions improve. Firms with no successors cannot benefit from interest rate smoothing through lending relationships with banks (as argued by Boot, 2000); therefore, the credit supply for such firms is lower, especially during an adverse shock. On the other hand, if firms with no successor repay debt to exit smoothly, the amount of bank borrowings and interest rates will be lower because the probability of default is low.

Third, we investigate the effects on firm performance. The lack of successors for firms with elderly managers suggests that these firms will exit from the market in the near future. We predict that the lack of a successor lowers firm performance (in terms of sales growth and ROA) if the shadow of death effects are significant. Additionally, the severe credit constraint for firms with no successors results in poor performance because they

cannot finance sufficient investment opportunities, even if the net present value of these opportunities is positive.

4.2 Regression

4.2.1 Estimation Strategy

Exit and default To investigate the effects of the lack of a successor on exit and default, we estimate the following equation:

$$Pr(D_{i,t+1} = 1) = \Phi(\alpha_1 No\ Successor_{i,t} + \mathbf{X}_{i,t}\alpha_2 + \epsilon_i + \zeta_i + \eta_t) \tag{2}$$

where the probabilities of default or exit are dependent variables for firm i in year t+1; $\mathbf{X}_{i,t}$ is a vector of control variables (firm size, firm age, leverage, ROA, sales growth, tangible fixed assets, cash holdings, interest rate and current assets); ϵ_i is the industry fixed effects of firm i; ζ_i is the regional fixed effects of firm i; and η_t is the year fixed effects from 2003 to 2014. Default is a dummy variable that takes a value of one if firms delay payments by more than 3 months, are bankrupt or virtually bankrupt borrowers, and/or are borrowers for which credit guarantee corporations subrogated between years t and t+1. Exit is a dummy variable that takes a value of one if we do not observe the data in years t+1 and t+2, and zero otherwise. Φ is the cumulative distribution function of the standard normal distribution. The definitions of firm size, firm age, leverage, interest rate, ROA, sales growth and cash holdings ratio are the same as those in section 3. Tangible fixed assets are defined as the ratio of tangible fixed assets to total assets in year t. Current assets are defined as the ratio of liquid assets minus cash holdings to total assets in year t.

We predict that creditworthy firms are unlikely to default and exit. Therefore, firm size, firm age, ROA, sales growth and cash holdings have negative effects on the probability of default and exit, making them less likely, whereas interest rate and leverage have

positive effects, making default and exit more likely. In addition, if firms with higher current assets have higher liquidity, current assets have a negative effect on the probability of default and exit, making it less likely. Tangible fixed assets are a proxy for collateral assets. If collateral assets prevent high-risk investments, the effects of tangible assets on the probability of default and exit are negative.

Bank borrowing We estimate the effects of the lack of a successor on bank borrowing as follows:

$$Bank\ Borrowings_{i,t+1} = \gamma_1 No\ Successor_{i,t} + \mathbf{W}_{i,t}\gamma_2 + \nu_i + \xi_t + \emptyset_{i,t}, \tag{3}$$

where bank borrowings (proxied by total borrowing growth and the interest rate in year t+1) is a dependent variable for firm i in year t+1; $\mathbf{W}_{i,t}$ is a vector of control variables (firm size, firm age, leverage, ROA, sales growth, tangible fixed assets, cash holdings and current assets in year t); ν_i is the firm fixed effects of firm i; ξ_t is the year fixed effects from 2003 to 2014; and $\emptyset_{i,t}$ is the error term of firm i in year t, with t ranging from 2003 to 2014. Sales growth in t+1 is defined as the annual change in firm sales [ln(1+sales in year t) – ln(1+sales in year t-1)]. Total borrowing growth in t+1 is defined as the annual change in total borrowing [ln(1+total borrowing in year t+1) – ln(1+total borrowing in year t)].

The control variables are measured as follows. Firm size is the natural logarithm of a firm's assets. Firm age is the natural logarithm of a firm's age. These are proxies for information transparency. As larger and older firms are typically more informationally transparent, they can more easily access bank loans. However, because firms can also draw on other financial sources as age and size increase, the demand for bank loans by such firms may be lower. In sum, firm size and age have some effects on bank loans, but the predicted signs are ambiguous. The amount of borrowings changes when there is a change in the demand for credit to finance investment opportunities. The firms with few

investment opportunities have lower credit demand. Previous studies (e.g., Asker et al., 2015) use Tobin's q and sales growth as proxies for investment opportunities. However, the data for Tobin's q are unavailable for this study because the small businesses on which we focus are typically unlisted firms. Therefore, as a proxy for credit demand, we use only sales growth, which has positive effects on bank borrowings. We also control credit demand by adding current assets and firm fixed effects. Leverage and ROA are proxies for the creditworthiness of borrowers. In general, tangible fixed assets are used as collateral assets; therefore, we control the effects of collateral assets by using tangible fixed assets and the effects of liquidity by using cash holdings.

Firm performance We estimate the effects of the lack of a successor on firm performance as follows:

$$Firm\ Performance_{i,t+1} = \gamma_1 No\ Successor_{i,t} + \mathbf{X}_{i,t}\gamma_2 + \nu_i + \xi_t + \varnothing_{i,t}, \tag{4}$$

where firm performance (proxied by ROA and sales growth in year t+1) is a dependent variable for firm i in year t+1; $\mathbf{W}_{i,t}$ is a vector of control variables (firm size, firm age, leverage, ROA, sales growth, tangible fixed assets, cash holdings, the interest rate and current assets in year t); ν_i is the firm fixed effects of firm i; ξ_t is the year fixed effects from 2003 to 2014; and $\varnothing_{i,t}$ is the error term of firm i in year t, when t is from 2003 to 2014. Sales growth in t+1 is defined as the annual change in firm sales [ln(1+sales in year t+1) – ln(1+sales in year t)]. ROA in t+1 is defined as the ratio of a firm's operating income to total assets. As noted above, we cannot use the market return or Tobin's q for our small businesses; therefore, we use accounting profitability as a proxy for firm performance.

We use ln(firm assets) as a proxy for firm size and ln(firm age) as a proxy for firm age. Leverage is the proxy for capital structure in year t. To control for the effects of current profitability and growth, we use ROA and sales growth in year t. Tangible fixed assets are a proxy for collateral assets. To control for firm liquidity, we use cash holdings.

Current assets are a proxy for short-term credit demand in year t. The interest rate is a proxy for the financial cost in year t.

4.2.2 Estimation Results

Exit and Default Table 4 displays the estimation results for equation (2). We show the estimated marginal effects at the mean. Columns (1) and (2) show the estimation results for the probability of exit. Column (1) shows that the marginal effect of no successor is positive and statistically significant at the 1% level. This result indicates that the lack of a successor increases the probability of exit by 3.82 percentage points. To investigate the heterogeneous effect of a successor between shock and non-shock periods, we estimate the interactive variables of no successor $\times$ shock and post-shock dummies. We define the shock period as the years from 2007 to 2009 and the post-shock period as 2010 to 2014. Column (2) shows the interactive variable between no successor and the shock or post-shock dummies. On the one hand, the marginal effect of no successor is 0.02928, suggesting that the probability of exit increases by 2.93 percentage points before the shock period if a firm has no successor. On the other hand, the marginal effect of no successor$\times$shock is 0.01961, suggesting that the positive effect of no successor increases by 1.961 percentage points during the shock period. These effects imply that the lack of a successor increases the probability of exit even more during the shock period than during normal times.

Column (3) shows that the estimated effects of no successor on the probability of default are positive and statistically significant at the 1% level. The marginal effect of no successor is 0.00228, suggesting that having no successor increases the probability of default by 0.228 percentage points . Column (4) shows the estimation results for the interactive variable. The estimated marginal effect of no successor is 0.00058. This suggests that the lack of a successor increases the probability of default by 0.058 percentage points , which is not economically significant. However, the marginal effect of no successor$\times$shock

period is 0.00170 and that of no successor×post-shock period is 0.00190, which are both statistically significant at the 1% level. These results suggest that the effects of no successor on the probability of default are larger during periods of adverse economic shocks, which supports our hypothesis.

The effects of control variables are as follows. The estimated probability of exit is higher if firm size, ROA, sales growth, leverage, the interest rate, tangible assets, cash holdings and current assets are lower, and if firm age is higher. Our proxy of exit is firms that exit from our database. Thus, exiting firms include those that end their relationships with banks that have CRD membership, as well as those that exit from the market. Therefore, our estimated results show that creditworthy (older and lower leveraged) firms are likely to exit because they can easily change their lending relationships. The estimated probability of default is higher if firm age, ROA, sales growth, tangible assets and cash holdings are lower, and if firm size, leverage, the interest rate and current assets are higher. The estimated results for firm default suggest that the probability of default is lower for creditworthy firms.

Bank Borrowing Table 5 shows the estimation results for Δbank borrowing (columns 1 and 2) and the interest rate (columns 3 and 4) in year t+1. Column (1) shows that the estimated coefficient of no successor is -0.0258, i.e., that the lack of a successor decreases bank borrowings by 2.58%. Column (2) shows the result for the interactive variable of no successor and the shock or post-shock period dummies. The estimated coefficient of no successor is -0.00383, which is not statistically significant. The estimated coefficient of no successor× shock is negative and statistically significant at the 1% level, which indicates that the lack of a successor decreases bank borrowing by 1.523%(=0.383%+1.140%) during the shock period. Additionally, the estimated coefficient of no successor×post-shock is negative and statistically significant at the 1% level. These results suggest that the lack of a successor lowers bank borrowings, especially during and after a shock period.

Columns (3) and (4) show the estimated coefficients of the effect of no successor on

interest rates. The coefficient is positive and statistically significant and indicates that the lack of a successor increases the interest rate by 0.013 percentage points (column 3). The estimation results support the positive effects on the interest rate of no successor, but the magnitude is not large. The coefficients of no successor×shock or post-shock dummies are negative and statistically significant (column 4). In summary, the Δbank borrowing is lower and the interest rate is higher if small businesses with elderly managers do not have a successor. These results imply that the supply of loans for these small businesses is low, which is consistent with the results indicating that the probability of default is high.

Columns (1) and (2) show that the coefficients of firm size, leverage, tangible assets, cash holdings and current assets are negative, whereas those of firm age and ROA are positive, and all are statistically significant. Columns (3) and (4) show that the coefficients of firm size, firm age, ROA and leverage are positive, and that those of sales growth and cash holdings are negative, and all are statistically significant.

Firm Performance Table 6 shows the estimation results for firm performance proxied by ROA (in columns 1 and 2) and sales growth (in columns 3 and 4). The coefficients of no successor are positive and statistically significant at the 1% level (column 1). In addition, the coefficients of no successor×shock or post-shock are negative and statistically significant (column 2). These results suggest that the lack of a successor has positive effects on ROA, but these effects weaken during and after a shock period. In columns (3) and (4), the estimated coefficients of no successor are positive and statistically significant. In addition, column (4) shows that the interactive variables are negative or not statistically significant. In sum, the estimation results for firm performance imply that firms with no successor are not lower performing, although they are risky and face severe credit constraints. These estimation results suggest that firms with no successor are not low-performing firms, which is not consistent with our hypothesis. This implies that credit constraints do not have significant negative effects on firm performance.

4.3 Propensity Score Matching

4.3.1 Estimation Strategy

In the previous section, we showed that firms with no successor are more likely to exit and default, and that they borrow less. Further, their performance is higher (not lower) compared with firms with a successor. However, these results can be biased because whether there is a successor is not exogenously determined. As Table 3 shows, larger, older, growing and non-financially distressed firms are more likely to appoint a successor. Therefore, the dependent variable of no successor can be a proxy for a lack of creditworthiness, not the lack of a successor. It is natural that less creditworthy firms borrow less because the probability of default for these firms is high. To mitigate the endogeneity, we use propensity score matching, which was introduced by Rosenbaum and Rubin (1983), to investigate the effects of the existence of a successor on firm default, borrowing and performance.

In this paper, the treatment group is a subsample of firms with elderly managers that do not have successors. The control group is a subsample of firms with elderly managers that have successors. The propensity score is the probability of receiving treatment, which is the probability that firms do not have a successor in our paper. To calculate the propensity score $Pr(\mathbf{Z}_{i,t})$, we estimate the probability of succession using the following probit model:

$$Pr(\mathbf{Z}_{i,t}) \equiv Pr(No\ Successor_{i,t} = 1 \mid \mathbf{Z}_{i,t}) = \Phi(\mathbf{Z}_{i,t}\rho), \tag{5}$$

where $\mathbf{Z}_{i,t} = (Firm\ size, Firm\ age, Leverage, ROA, Sales\ growth, Cash\ holdings,$
$Interest\ rate, Current\ assets, Manager\ age\ dummies, Industry\ dummies and Regional\ dummies)$.
The definitions of variables $\mathbf{Z}_{i,t}$ are the same as those in subsection 3. Φ is the cumulative distribution function of the standard normal distribution. We limit the observations to those for which the outcome variables in t+1 are available. Similar to section 3, we limit

the observations to those involving firms with managers aged 60 years or older. We estimate equation (5) divided by years to control the year fixed effects. Creditworthiness is controlled using leverage and the interest rate. Credit demand is controlled by using sales growth, current assets and industry and regional dummies. Liquidity and profitability are controlled by cash holdings and ROA.

Using the estimated coefficients in equation (5), we calculate the estimated propensity score $[\hat{Pr}(\mathbf{Z}_{i,t})]$ for each observation and match the observations based on the estimated propensity score. We estimate the propensity score by matching each treatment observation using one-to-one nearest-neighbour matching. After matching treated firms to control firms, we can compare firms that are similar in terms of creditworthiness, credit demand, liquidity, profitability , firm size, and age.

To check whether the matching is suitable, we use the balancing test. Table 7 shows the differences of the independent variables used in the probit estimation in equation (5) before and after matching. The "Unmatched" row shows the difference between the treated and unmatched control firms for the mean of each variable. The "Matched" row shows the difference using the treated and matched control firms.[8] This table shows that the differences in many variables between treated and unmatched control firms are statistically significant at the 1% level. After the matching, even though the differences of some variables are statistically significant, many become statistically insignificant. This suggests that the firm characteristics are similar between firms with and without a successor after matching.

4.3.2 Exit and Default

Table 8 shows the estimation results for the propensity score matching method. We show the estimated average treatment effect on the treated in the "ATET" column and the standard error in the "Std. Err" column. Column (1) shows the estimation results using

[8]The results in the table for the balancing test use default as an outcome variable.

exit as an outcome variable. The estimated ATET of no successor on exit is positive and statistically significant at the 1% level in all years, and increases the probability of exit by 2.51 to 5.73 percentage points . We can observe heterogeneous effects between the shock and non-shock periods. The estimated ATETs are around 2 or 3% during the non-shock period (before 2006), whereas they are around 5 or 6% during the shock period (2007–2009). During the post-shock period (after 2010), they are around 4%. This implies that the probability of exit for firms with no successor increases during the shock period, which is similar to the results in Table 4.

Column (2) shows the estimation results using default as an outcome variable. On the one hand, the estimated ATETs of no successor are statistically insignificant during the non-shock period (before 2005). In 2006, the estimated ATETs of no successor are statistically significant at the 10% level. On the other hand, during the shock and post-shock periods (after 2007), the estimated ATETs are negative and statistically significant at the 1% level. The magnitude of the ATET is largest in 2009, when having no successor increases the probability of default by 0.531 percentage points . During the post-shock period, the estimated ATET is around 0.4 or 0.5%. As Table 2 shows, the average value of default is 0.993%, and the effects of no successor on default are economically significant.

4.3.3 Bank Borrowings

Column (3) shows the estimated ATETs of Δbank borrowing between year t and year t+1. The estimated ATETs are statistically insignificant during the non-shock period. However, the estimated ATETs of no successor are negative and statistically significant in shock and post-shock periods (after 2007), except for 2009, 2010, and 2011. This suggests that firms with no successor decrease bank borrowings by 3.14 to 6.64% during this period. As column (2) shows, the firms with no successor are more likely to default during the shock and post-shock periods. Banks reduce lending to these firms because they are riskier. However, these negative effects are insignificant from 2009 to 2011,

despite this being a shock period. The reason is that the Emergency Credit Guarantee program, which operated between September 2008 and March 2010, enhanced the credit supply from banks, especially for risky firms[9] Column (4) shows the estimated ATET of the interest rate. We use the differentiated value between year t and year t+1 to control firm fixed effects for the interest rate. The estimated ATETs are all positive, but statistically significant only in 2006, 2008, 2009, 2011 and 2014.

4.3.4 Firm Performance

Column (5) shows the estimated ATETs of no successor on ROA. Similar to column (5), we show the differentiated values between t and t+1. The estimated ATETs of ROA are negative and statistically significant in 2006, 2010 and 2011. However, the estimated ATETs in other years are not statistically significant. These results imply that ROA for firms with no successor is neither lower nor higher than ROA for other firms. Column (6) shows the estimated ATETs on sales growth between t and t+1. The estimated ATETs are all negative and statistically significant. This suggests that firms with no successor are growing more slowly than other firms. The magnitude of the ATETs is larger during the shock period. For example, the estimated ATET is -0.03612 in 2009, suggesting that the sales growth of firms with no successor is lower by 3.61%. These results imply that firm growth is lower if there is no successor, which is consistent with our hypothesis.

4.3.5 Estimation Effects of Finding a Successor

Using the propensity score matching method, we have shown the estimated effects of no successor. However, no successor is defined using variables only in year t. Therefore, we do not estimate whether a change in the existence of a successor has any effects on firm performance, borrowing and default. To do this, we limit the sample to firms that do not have a successor from year t-2 to year t. Table 9 shows the number of observations for

[9]See Ono et al. (2013) and Tsuruta (2015) for more detail about the Emergency Credit Guarantee program.

firms that do not have a successor in year t or between year t-2 and year t, divided by those with no successor in year t+1. This table shows that, for some observations, the firms find a successor until the next year. We use this change to estimate the effects of having no successors.

We define the treatment (control) group as firms that have (do not have) a successor in year t+1. This illustrates the case in which firms with an elderly manager find a successor. If having no successor increases the probabilities of default and exit, the treatment effects of finding a successor are negative on these probabilities (i.e., they lower the probabilities of default and exit). Additionally, if having no successor lowers the credit supply from banks, the treatment effects on the interest rate are negative and those on bank borrowings are positive. Furthermore, if having no successor lowers firm performance, the treatment effects on sales growth and ROA are positive. By employing these estimation strategies, we can show the effects of no successor more accurately. However, the number of observations for the control group decreases; thus, the accuracy of matching is reduced compared with the estimation using all observations.

In Table 10, we show the estimation results of the propensity score matching method, focusing on finding a successor. We use the same variables shown in equation (5) to match the control and treatment groups. To control the year fixed effects, we employ exact matching by year. The outcome variables are the same as in the previous section. In addition to the effects in year t+1, we show those in t+2 and t+3. Column (1) shows the effects on the probability of exit. We define exit as occurring in t+2 (or t+3) if we do not observe the data in years t+2 and t+3 (or years t+3 and t+4); otherwise the exit variable has a value of zero. The ATETs are negative and statistically significant at the 1% level for exit in both years t+2 and t+3. Column (2) shows that the ATETs for probabilities of default. Default in t+s is a dummy variable that takes a value of one if firms delay payments by more than 3 months, are bankrupt or virtually bankrupt borrowers and/or are borrowers for which credit guarantee corporations subrogated between years t and

t+s (s = 1, 2 or 3). The ATETs are negative and statistically significant at the 1% or 10% levels. These results suggest that having no successor increases the probabilities of exit and default, which is consistent with the results in the previous sections.

Column (3) shows the ATETs of finding a successor on Δbank borrowings. Δbank borrowings in t+s is the change of ln(bank borrowing) from year t to t+s (s = 1, 2 or 3). The ATETs are positive and statistically significant at the 1% level. Column (4) shows the ATETs of finding a successor on the interest rate. Similar to Table 8, we show the average difference of the interest rate from year t to t+s (s = 1, 2 or 3) to control for the heterogeneity of firms. The ATETs are negative and statistically significant at the 1% or 5% levels. These results imply that the credit restrictions for firms with no successors are severe.

Finally, columns (5) and (6) show the ATETs on firm performance. We also use the difference of ROA from year t to t+s (s = 1, 2 or 3) to control for firm heterogeneity. The ATETs of finding a successor on sales growth from year t to t+s (s = 1, 2 or 3) are all positive and statistically significant at the 1% level. This implies that having no successors has negative effects on firm growth. However, the ATETs on ROA are positive, but statistically insignificant. Similar to the estimation results in Table 8, having no successors lowers firm growth, but has weak effects on profitability.

5 Conclusion

We investigate whether the lack of a successor has any effects on firm default and exit, bank borrowing and firm performance using a large sample of firms with elderly managers in Japan. As the firms are likely to exit from the market if their manager is elderly and a successor is not appointed, they have less incentive to repay loans. As a result, the probability of default is higher for firms with no successor. As the credit risk of firms with no successor is high, banks offer less credit to these firms. Further, these firms are lower performing than other firms because they are more likely to exit from the market

and to face severe credit constraints. The estimation results using our large dataset on small businesses in Japan support the above hypotheses.

As the populations of many countries continue to age in the future, the average age of the managers of small businesses is also increasing. Therefore, succession is becoming more and more important for many small businesses. To achieve smooth succession, the existence or lack of a successor is important for small business management. In this paper, we contribute significantly to the small business economics literature by showing the effects of the lack of a successor on the activities of firms with elderly managers.

Recently, many small businesses in Japan have experienced difficulties in replacing elderly small business managers with new managers. Thus, the problem of lacking a successor is widespread. To mitigate this issue of low numbers of potential successors and actual successions, the Japanese government has provided financial support, tax reductions and subsidies to SMEs.[10] These policies might increase the number of potential successors and actual successions. However, our estimation results suggest that the creditworthiness and growth rates of firms are low if they lack successors. Therefore, some financially and economically distressed firms that should exit the market do not do so because of the government support they receive. Thus, the policies designed to assist succession could impede the operation of the market mechanism, as well as having the intended effects of enhancing the numbers of potential successors and actual successions. These issues remain a subject for future investigation.

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[10]See *2019 White Paper on Small and Medium Enterprises in Japan* by the Small and Medium Enterprise Agency (see https://www.chusho.meti.go.jp/pamflet/hakusyo/) (last date accessed: June 2019)

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Table 1: Ratio of Number of Firms with No Successor, Divided by Year and Manager's Age

	Current manager's age			
year	60–69	70–79	80+	Total
2003	0.3489	0.2518	0.1981	0.3213
2004	0.3535	0.2538	0.2023	0.3250
2005	0.3886	0.2888	0.2245	0.3582
2006	0.4277	0.3225	0.2410	0.3954
2007	0.4177	0.3125	0.2346	0.3869
2008	0.3858	0.2681	0.1969	0.3529
2009	0.3776	0.2569	0.1757	0.3435
2010	0.3773	0.2484	0.1690	0.3395
2011	0.3915	0.2599	0.1877	0.3513
2012	0.3966	0.2626	0.1799	0.3536
2013	0.4118	0.2714	0.1844	0.3653
2014	0.4212	0.2831	0.2022	0.3733
2015	0.4264	0.2813	0.1994	0.3748
Total	0.3950	0.2730	0.1965	0.3574

Note: This table shows the ratio of the number of firms with no successor to the total number of firms. We use only firms with managers aged 60 years and over.

Table 2: Summary Statistics

Variable	N	Mean	SD	Min	p1	p50	p99	Max
No successor	991,098	0.3574	0.4792	0.0000	0.0000	0.0000	1.0000	1.0000
Default	991,098	0.0099	0.0991	0.0000	0.0000	0.0000	0.0000	1.0000
Exit	824,614	0.1161	0.3203	0.0000	0.0000	0.0000	1.0000	1.0000
Firm size	991,098	11.0526	1.3635	0.0000	8.0925	11.0054	14.6484	21.3055
Firm age	991,098	3.3290	0.5391	1.6094	1.6094	3.4012	4.2485	5.0106
Leverage	991,098	1.1554	0.9029	0.0000	0.1835	0.9281	5.3668	8.6944
ROA	991,098	-0.0238	0.1645	-1.4444	-0.6961	0.0060	0.3405	0.5872
Cash holdings	991,098	0.1755	0.1623	0.0000	0.0018	0.1266	0.7019	1.0000
Sales growth	991,098	-0.0361	0.3447	-15.1739	-0.9624	-0.0209	0.7702	1.5816
70–79 age	991,098	0.2399	0.4270	0.0000	0.0000	0.0000	1.0000	1.0000
80 and over age	991,098	0.0419	0.2004	0.0000	0.0000	0.0000	1.0000	1.0000
Interest rate	991,098	0.0213	0.0143	0.0000	0.0000	0.0201	0.0684	0.1345
Tangible assets	991,098	0.3414	0.2744	0.0000	0.0000	0.2826	0.9612	1.0000
Current assets	991,098	0.3771	0.2416	-0.5401	0.0015	0.3497	0.9267	1.0000
Total borrowings growth	737,653	0.0095	0.4042	-6.3986	-0.9578	-0.0139	1.2710	9.0059

Note: This table provides summary statistics for the variables used in the econometric analysis.

Table 3: Estimated Results of the Probit Estimation for the Determinants of the Lack of a Successor

	(1)	(2)	(3)	(4)
Dependent variable	No Successor	No Successor	No Successor	No Successor
Year	All	2003–2006	2007–2009	2010–2014
Firm size	-0.04401***	-0.03470***	-0.04371***	-0.04810***
	(0.00044)	(0.00096)	(0.00085)	(0.00062)
Firm age	-0.01480***	-0.00777***	-0.00645***	-0.02255***
	(0.00098)	(0.00212)	(0.00186)	(0.00137)
Leverage	0.01405***	0.01402***	0.01584***	0.01267***
	(0.00061)	(0.00161)	(0.00123)	(0.00078)
Interest rate	0.39519***	0.76340***	0.43763***	0.16807***
	(0.03532)	(0.07217)	(0.06321)	(0.05292)
ROA	0.02104***	0.00401	0.02218***	0.02595***
	(0.00314)	(0.00806)	(0.00592)	(0.00421)
Cash holdings	0.03173***	0.06499***	0.04168***	0.01328***
	(0.00318)	(0.00761)	(0.00620)	(0.00426)
Sales growth	-0.04236***	-0.03025***	-0.04559***	-0.04622***
	(0.00148)	(0.00332)	(0.00291)	(0.00202)
Current assets	0.08648***	0.10505***	0.09077***	0.07668***
	(0.00223)	(0.00492)	(0.00427)	(0.00311)
70–79 age	-0.11754***	-0.09124***	-0.11096***	-0.12868***
	(0.00109)	(0.00243)	(0.00214)	(0.00149)
80 and over age	-0.17916***	-0.14585***	-0.17461***	-0.19080***
	(0.00196)	(0.00465)	(0.00408)	(0.00256)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes
Observations	991,098	208,302	271,355	511,441

This table presents estimates from the maximum-likelihood probit regressions with no successor as the dependent variables. No successor is a dummy variable equal to one if the successor has not been identified. Firm size is defined as the natural logarithm of a firm's total assets in year t. Firm age is defined as the natural logarithm of a firm's age in year t. Leverage is defined as the book value of debt divided by the book value of assets in year t. ROA is defined as the ratio of a firm's operating income to total assets in year t. Sales growth is defined as the natural logarithm of 1 + a firm's total sales in year t minus those in year t–1. Cash holdings are defined as the ratio of a firm's cash holdings to total assets in year t. The 70–79 age dummy equals one if a firm's manager is aged 70 to 79 years. The 80-and-over age dummy equals one if a firm's manager is aged 80 years and older. The marginal effects of each variable at the mean are provided in each column. The estimation results for the constant term are omitted. The estimated standard errors are shown in parentheses. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 4: Estimated Results for the Effects of No Successor on Exit and Default

	(1)	(2)	(3)	(4)
Dependent variable	Exit	Exit	Default	Default
No successor	0.03826***	0.02928***	0.00228***	0.00058**
	(0.00075)	(0.00158)	(0.00014)	(0.00030)
No successor×shock		0.02156***		0.00213***
		(0.00212)		(0.00047)
No successor×post-shock		0.00372**		0.00225***
		(0.00183)		(0.00042)
Firm size	-0.02473***	-0.02472***	0.00142***	0.00142***
	(0.00031)	(0.00031)	(0.00006)	(0.00006)
Firm age	0.00401***	0.00395***	-0.00048***	-0.00047***
	(0.00066)	(0.00066)	(0.00012)	(0.00012)
ROA	-0.02776***	-0.02767***	-0.00984***	-0.00982***
	(0.00196)	(0.00196)	(0.00033)	(0.00033)
Sales growth	-0.02507***	-0.02506***	-0.00266***	-0.00265***
	(0.00088)	(0.00088)	(0.00011)	(0.00011)
Leverage	-0.00304***	-0.00304***	0.00219***	0.00219***
	(0.00039)	(0.00039)	(0.00006)	(0.00006)
Interest rate	-1.04718***	-1.04680***	0.17989***	0.17978***
	(0.02438)	(0.02438)	(0.00400)	(0.00400)
Tangible assets	-0.02101***	-0.02093***	-0.00175***	-0.00174***
	(0.00244)	(0.00244)	(0.00043)	(0.00043)
Cash holdings	-0.02888***	-0.02889***	-0.03484***	-0.03475***
	(0.00300)	(0.00300)	(0.00067)	(0.00067)
Current assets	-0.03348***	-0.03344***	0.00172***	0.00172***
	(0.00254)	(0.00254)	(0.00044)	(0.00044)
Observations	824,614	824,614	991,098	991,098
Firm fixed effects	No	No	No	No
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Regional fixed effects	Yes	Yes	Yes	Yes

This table presents estimates from the maximum-likelihood probit regressions with exit (columns 1 and 2) or default (columns 3 and 4) as the dependent variables. Tangible fixed assets are defined as the ratio of a firm's tangible fixed assets to total assets in year t. The interest rate is defined as the ratio of a firm's interest expenses to the sum of its short- and long-term debt and discounted notes receivable in year t. Current assets are defined as the ratio of liquid assets minus cash holdings to total assets in year t. The definitions of the other independent variables are in the notes accompanying Table 3. The estimation results for the constant term are omitted. The marginal effects of each variable at the mean are provided in each column. The estimated standard errors are shown in parentheses. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 5: Estimated Results for the Effects of No Successor on ΔBank Borrowings and Interest Rate

	(1)	(2)	(3)	(4)
Dependent variable	Total borrowings growth (t+1)	Total borrowings growth (t+1)	Interest rate (t+1)	Interest rate (t+1)
No successor	-0.02046***	-0.00383	0.00013***	0.00025***
	(0.00195)	(0.00316)	(0.00004)	(0.00007)
No successor×shock		-0.01140***		-0.00019**
		(0.00351)		(0.00008)
No successor×post-shock		-0.03000***		-0.00014*
		(0.00360)		(0.00008)
Firm size	-0.38042***	-0.38112***	0.00266***	0.00266***
	(0.00245)	(0.00245)	(0.00005)	(0.00005)
Firm age	0.00246	0.00330	0.00047***	0.00047***
	(0.00444)	(0.00444)	(0.00010)	(0.00010)
ROA	0.19922***	0.19930***	0.00098***	0.00098***
	(0.00448)	(0.00448)	(0.00010)	(0.00010)
Sales growth	0.03013***	0.03004***	-0.00007*	-0.00007*
	(0.00174)	(0.00174)	(0.00004)	(0.00004)
Leverage	-0.13123***	-0.13073***	0.00026***	0.00026***
	(0.00171)	(0.00171)	(0.00004)	(0.00004)
Tangible assets	-0.16997***	-0.17009***	-0.00002	-0.00002
	(0.01219)	(0.01219)	(0.00026)	(0.00026)
Cash holdings	-0.11558***	-0.11551***	-0.00306***	-0.00305***
	(0.01219)	(0.01219)	(0.00026)	(0.00026)
Current assets	-0.02562**	-0.02578**	-0.00003	-0.00003
	(0.01138)	(0.01138)	(0.00025)	(0.00025)
Observations	737,653	737,653	734,998	734,998
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Regional fixed effects	No	No	No	No

This table presents estimates of the fixed-effects regressions (equation 4) with δbank borrowings $[(total\ borrowings_{t+1} - total\ borrowings_t)/total\ assets_t]$ and the interest rate in year t+1 as the dependent variable. The definitions of the independent variables are in the notes accompanying Tables 3 and 4. The estimation results for the constant term are omitted. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 6: Estimated Results for the Effects of No Successor on ROA and Sales Growth

	(1)	(2)	(3)	(4)
Dependent variable	ROA(t+1)	ROA(t+1)	Sales growth(t+1)	Sales growth(t+1)
No successor	0.00307***	0.00750***	0.00387***	0.00755***
	(0.00066)	(0.00106)	(0.00132)	(0.00214)
No successor×shock		-0.00311***		-0.00285
		(0.00118)		(0.00238)
No successor×post-shock		-0.00796***		-0.00639***
		(0.00121)		(0.00244)
Firm size	-0.02342***	-0.02361***	-0.01574***	-0.01589***
	(0.00083)	(0.00083)	(0.00168)	(0.00168)
Firm age	0.00987***	0.01009***	-0.01519***	-0.01502***
	(0.00149)	(0.00149)	(0.00300)	(0.00300)
ROA	0.00545***	0.00548***	-0.19942***	-0.19941***
	(0.00156)	(0.00156)	(0.00308)	(0.00308)
Sales growth	0.00423***	0.00421***	-0.25975***	-0.25977***
	(0.00059)	(0.00059)	(0.00129)	(0.00129)
Leverage	0.06223***	0.06236***	0.06468***	0.06478***
	(0.00061)	(0.00061)	(0.00117)	(0.00118)
Interest rate	0.09295***	0.09198***	-1.23540***	-1.23617***
	(0.02140)	(0.02140)	(0.04313)	(0.04313)
Tangible assets	0.02870***	0.02867***	0.05250***	0.05249***
	(0.00412)	(0.00412)	(0.00830)	(0.00830)
Cash holdings	-0.04891***	-0.04890***	-0.13274***	-0.13271***
	(0.00412)	(0.00412)	(0.00830)	(0.00830)
Current assets	-0.00587	-0.00592	0.11923***	0.11921***
	(0.00385)	(0.00385)	(0.00775)	(0.00775)
Observations	735,521	735,521	735,723	735,723
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	No	No	No	No
Regional fixed effects	No	No	No	No

This table presents estimates of the fixed-effects regressions (equation 4) with ROA and sales growth in year t+1 as the dependent variable. The definitions of the independent variables are in the notes accompanying Tables 3 and 4. The estimation results for the constant term are omitted. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 7: Difference Between the Treated and Control Samples Before and After Matching

Variable	Year	2003		2004		2005		2006		2007		2008	
Firm size	Unmatched	-0.3030	***	-0.3260	***	-0.3130	***	-0.3230	***	-0.3490	***	-0.4160	***
	Matched	-0.0050		-0.0030		-0.0010		0.0060		-0.0040		-0.0120	
Firm age	Unmatched	-0.0618	***	-0.0658	***	-0.0556	***	-0.0515	***	-0.0564	***	-0.0695	***
	Matched	0.0129	**	0.0072		-0.0050		0.0091	*	0.0001		-0.0044	
Leverage	Unmatched	0.0629	***	0.0732	***	0.1133	***	0.1355	***	0.1365	***	0.1428	***
	Matched	0.0025		-0.0005		-0.0125		-0.0113		-0.0151	**	-0.0216	***
Interest rate	Unmatched	0.0000		0.0002		0.0003	**	0.0000		0.0001		-0.0004	***
	Matched	-0.0002		-0.0001		-0.0001		-0.0002		0.0000		-0.0001	
ROA	Unmatched	-0.0049	***	-0.0074	***	-0.0032	**	-0.0045	***	-0.0093	***	-0.0114	***
	Matched	-0.0004		0.0013		0.0000		0.0027	*	0.0000		0.0000	
Cash holdings	Unmatched	0.0078	***	0.0069	***	0.0044	***	0.0081	***	0.0105	***	0.0084	***
	Matched	-0.0006		-0.0005		-0.0007		-0.0016		-0.0007		0.0005	
Sales growth	Unmatched	-0.0140	***	-0.0127	***	-0.0102	***	-0.0172	***	-0.0180	***	-0.0238	***
	Matched	-0.0004		-0.0023		-0.0013		0.0003		-0.0061	**	-0.0034	
Current assets	Unmatched	0.0258	***	0.0292	***	0.0313	***	0.0290	***	0.0250	***	0.0291	***
	Matched	0.0038		-0.0029		0.0000		-0.0029		-0.0009		-0.0012	
70–79 age	Unmatched	-0.0724	***	-0.0739	***	-0.0712	***	-0.0722	***	-0.0724	***	-0.0827	***
	Matched	0.0052		0.0005		0.0018		-0.0009		-0.0004		-0.0029	
80 and over age	Unmatched	-0.0207	***	-0.0215	***	-0.0245	***	-0.0255	***	-0.0229	***	-0.0241	***
	Matched	-0.0012		-0.0006		-0.0022		-0.0004		-0.0014		-0.0017	

Variable	Year	2009		2010		2011		2012		2013		2014	
Firm size	Unmatched	-0.4490		-0.4550		-0.4760		-0.4890		-0.4930		-0.4600	
	Matched	-0.0040		-0.0070		-0.0080		-0.0070		-0.0020		-0.0150	
Firm age	Unmatched	-0.0814	***	-0.0920	***	-0.0910	***	-0.0995	***	-0.1004	***	-0.0937	***
	Matched	0.0030		0.0058		0.0027		0.0035		0.0009		0.0031	
Leverage	Unmatched	0.1528	***	0.1785	***	0.1960	***	0.1949	***	0.2081	***	0.1925	***
	Matched	-0.0119		-0.0220	**	-0.0163	*	-0.0106		-0.0302	***	-0.0161	*
Interest rate	Unmatched	-0.0005	***	-0.0005	***	-0.0005	***	-0.0004	***	-0.0004	***	-0.0004	***
	Matched	0.0001		0.0002		0.0001		0.0001		0.0001		0.0000	
ROA	Unmatched	-0.0176	***	-0.0187	***	-0.0155	***	-0.0125	***	-0.0094	***	-0.0059	***
	Matched	0.0021		0.0014		0.0028	*	0.0022		-0.0007		0.0015	
Cash holdings	Unmatched	0.0050	***	0.0033	***	0.0070	***	0.0062	***	0.0059	***	0.0055	***
	Matched	-0.0009		-0.0006		0.0001		-0.0010		-0.0007		-0.0007	
Sales growth	Unmatched	-0.0298	***	-0.0389	***	-0.0253	***	-0.0289	***	-0.0255	***	-0.0256	***
	Matched	-0.0032		-0.0028		-0.0023		-0.0012		0.0020		-0.0018	
Current assets	Unmatched	0.0278	***	0.0301	***	0.0250	***	0.0283	***	0.0293	***	0.0305	***
	Matched	-0.0030		-0.0009		-0.0020		-0.0014		-0.0012		-0.0006	
70–79 age	Unmatched	-0.0848	***	-0.0925	***	-0.0960	***	-0.0991	***	-0.1036	***	-0.1038	***
	Matched	0.0025		-0.0028		-0.0008		-0.0005		0.0006		-0.0005	
80 and over age	Unmatched	-0.0274	***	-0.0308	***	-0.0306	***	-0.0340	***	-0.0363	***	-0.0360	***
	Matched	-0.0030	***	-0.0041	***	-0.0024	*	-0.0027	**	-0.0047	***	-0.0030	**

Note: This table details the differences in the independent variables used in the probit estimation in equation (5) before and after matching. The "Unmatched" row shows the difference between the treated and unmatched control firms for the mean of each variable (x for treated–x for controls). The "Matched" row shows the difference for the matched control firms. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 8: Estimated Results for the Propensity Score Matching Method

	(1)			(2)			(3)		
	Exit			Default			ΔBank borrowing		
	ATET	Std. Err.	obs	ATET	Std. Err.	obs	ATET	Std. Err.	obs
2003	0.03310***	(0.004)	51,253	0.00158	(0.001)	51,253	-0.03803	(0.024)	35,736
2004	0.02744***	(0.004)	53,146	-0.00029	(0.001)	53,146	-0.00735	(0.023)	34,011
2005	0.02509***	(0.004)	49,861	-0.00034	(0.001)	49,861	-0.01851	(0.025)	29,147
2006	0.02847***	(0.004)	54,042	0.00234*	(0.001)	54,042	-0.00872	(0.024)	34,888
2007	0.04769***	(0.003)	79,695	0.00396***	(0.001)	79,695	-0.04918***	(0.018)	53,250
2008	0.05335***	(0.003)	99,579	0.00492***	(0.001)	99,579	-0.03135*	(0.019)	57,847
2009	0.05973***	(0.003)	92,081	0.00531***	(0.001)	92,081	-0.01202	(0.017)	58,070
2010	0.03795***	(0.003)	92,362	0.00411***	(0.001)	92,362	-0.02681	(0.016)	57,088
2011	0.04322***	(0.003)	88,130	0.00433***	(0.001)	88,130	-0.02462	(0.016)	54,209
2012	0.03978***	(0.004)	84,792	0.00450***	(0.001)	84,792	-0.04632***	(0.016)	51,845
2013	0.04403***	(0.004)	79,673	0.00416***	(0.001)	79,673	-0.06642***	(0.015)	50,981
2014				0.00416***	(0.001)	81,746	-0.04972***	(0.014)	52,447

	(4)			(5)			(6)		
	Interest rate			ROA			Sales growth		
	ATET	Std. Err.	obs	ATET	Std. Err.	obs	ATET	Std. Err.	obs
2003	0.00013	(0.000)	35,509	-0.00380	(0.003)	35,666	-0.01622***	(0.006)	35,778
2004	0.00029	(0.000)	33,845	0.00290	(0.003)	33,960	-0.01170**	(0.006)	34,064
2005	0.00032	(0.000)	28,978	-0.00067	(0.003)	29,126	-0.02325***	(0.006)	29,202
2006	0.00036**	(0.000)	34,725	-0.00407*	(0.002)	34,872	-0.02564***	(0.008)	34,953
2007	-0.00003	(0.000)	53,077	0.00372	(0.002)	53,205	-0.01902***	(0.005)	53,396
2008	0.00025*	(0.000)	57,776	0.00321	(0.002)	57,806	-0.03177***	(0.006)	58,061
2009	0.00023*	(0.000)	58,062	-0.00001	(0.002)	58,020	-0.03612***	(0.005)	58,317
2010	0.00012	(0.000)	57,088	-0.00661***	(0.002)	57,072	-0.02774***	(0.005)	57,354
2011	0.00021*	(0.000)	54,068	-0.00431*	(0.002)	54,186	-0.02597***	(0.006)	54,488
2012	-0.00000	(0.000)	51,499	-0.00235	(0.002)	51,803	-0.02191***	(0.005)	52,087
2013	0.00004	(0.000)	50,894	-0.00318	(0.002)	50,907	-0.01697***	(0.006)	51,217
2014	0.00021*	(0.000)	52,307	0.00166	(0.002)	52,374	-0.02275***	(0.005)	52,666

This table provides estimates of the treatment effects on exit, default, bank borrowings, the interest rate, ROA and sales growth. The "ATET" column shows the average treatment effects on the treated in year t. The standard errors are in the "Std. Err" column. The definitions of the variables are in the notes accompanying Tables 3 and 4. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.

Table 9: Changes from No Successors in the Next Year

		No successors in year t+1		
		=1	=0	Total
No successors in year t	=1	354,894	28,222	383,116
	=0	21,504	166,963	188,467
No successors from years t-2 to t	=1	88,051	7,417	95,468

[11]ote: This table shows the number of observations that no successors equal zero or not in year t (or years in t-2, t-1 and t), divided by no successors in year t+1.

Table 10: Estimated Results for the Propensity Score Matching Method: Focusing on Finding a Successor

	(1)			(2)			(3)		
	Exit			Default			ΔBank borrowing		
	ATET	Std. Err.	obs	ATET	Std. Err.	obs	ATET	Std. Err.	obs
t+1				-0.00162*	(0.001)	95,468	0.05670***	(0.021)	94,859
t+2	-0.02101***	(0.005)	75,178	-0.00769***	(0.002)	95,468	0.17626***	(0.032)	62,999
t+3	-0.01930***	(0.005)	65,399	-0.01470***	(0.003)	95,468	0.20959***	(0.042)	46,028

	(4)			(5)			(6)		
	Interest rate			ROA			Sales growth		
	ATET	Std. Err.	obs	ATET	Std. Err.	obs	ATET	Std. Err.	obs
t+1	-0.00050***	(0.000)	95,468	0.00088	(0.002)	94,823	0.02381***	(0.005)	94,807
t+2	-0.00044**	(0.000)	63,462	0.00046	(0.003)	62,879	0.03081***	(0.008)	62,866
t+3	-0.00056**	(0.000)	46,413	0.00313	(0.003)	45,882	0.06576***	(0.014)	45,857

This table provides estimates of the treatment effects on exit, default, bank borrowings, the interest rate, ROA and sales growth. The "ATET" column shows the average treatment effects on the treated in year t. The standard errors are in the "Std. Err" column. The definitions of the variables are in the notes accompanying Tables 3 and 4. The symbols *, ** and *** denote significance at the 10%, 5% and 1% levels, respectively.