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Abstract This study explores the impact of initial debt financing on the survival of start-up firms by identifying three types of exit routes: bankruptcy, voluntary liquidation, and merger. Using a discrete-time duration model for Japanese start-up firms, we examine how debt financing affects the time from founding to exit. We find that firms that initially rely on debt financing from outside creditors are more likely to go bankrupt and that long-term debt, rather than short-term debt, is positively associated with the time to exit due to bankruptcy. In contrast, such firms are less likely to liquidate voluntarily, and long-term debt is negatively associated with the time to voluntary liquidation. Moreover, they are less likely to exit via merger, and long-term debt is negatively associated with the time to exit via merger. Furthermore, unlike voluntary liquidation and merger, macroeconomic conditions influence the likelihood of bankruptcy.

Keywords: Bankruptcy; Debt financing; Long-term debt; Merger; Outside creditors; Start-up; Voluntary liquidation

JEL Classifications: G33; G34; M13

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Declaration of interest

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1 Introduction

Many, but not all, start-up firms raise their initial funds through debt financing from banks and other financial institutions. Because of the difficulties in generating internal financing in the early stages, a large number of start-up firms rely on debt financing. As expected, debt financing plays a critical role in launching new businesses (Cole and Sokolyk, 2018; Deloof et al., 2019; Robb and Robinson, 2014). On the premise that lenders—in most cases, banks and other financial institutions—select high-quality firms, start-up firms with debt financing are more likely to exhibit better performance than those that do not resort to debt financing (Cole and Sokolyk, 2018). Moreover, relationship lending based on close ties to financial institutions, such as banks, alleviates the funding gap for small and medium enterprises (SMEs) (Berger and Schaeck, 2011; Cressy, 2002). In the early stages, debt financing allows start-up firms to establish access to external capital, which helps improve firm performance in the later stages. However, even if debt financing fills the funding gap, interest payments on debt capital may unexpectedly burden start-up firms, thereby increasing the probability of bankruptcy (Honjo and Kato, 2019). In these respects, it is unclear whether debt financing improves or deteriorates start-up firm performance; in other words, it has both positive and negative effects on post-entry performance.

Numerous scholars in the entrepreneurship literature have examined post-entry performance, such as survival and growth, among start-up firms (Persson, 2004; Vivarelli, 2013). Some scholars have addressed the importance of exit routes (Cefis and Marsili, 2012; Coad and Kato, 2021; Grilli, 2011; Kato and Honjo, 2015). While debt financing influences post-entry performance, it may also determine the exit routes of start-up firms. Specifically, start-up firms that rely heavily on debt financing from outside creditors (external creditors) may find it difficult to choose voluntary liquidation based solely on their own volition because of close ties to financial institutions, such as banks. Moreover, even if start-up firms, especially technology-oriented start-ups, seek opportunities to exit via merger, debt financing from outside creditors may prevent private equity investors, such as venture capitalists, from

acquiring firms. This is because private equity investors are more willing to gain firm control than current lenders, including main banks. Therefore, reliance on debt financing in the early stages may preclude the choice of these exit routes. However, research on how start-up firms choose exit routes based on initial debt financing is scarce. Although exit routes may depend on the type of debt financing, little attention has been paid to the impact of the type of debt financing, such as debt from outside creditors or long-term debt, on exit routes. Further studies should provide a better understanding of how initial debt financing influences the survival and exit of start-up firms.

This study explores the impact of initial debt financing on the survival of start-up firms by identifying the types of exit routes: bankruptcy, liquidation, and merger. Using a discrete-time duration model for Japanese start-up firms, we identify whether firms that initially rely on debt financing are more likely to survive or exit. We provide evidence that the impact of initial debt financing differs between exit routes, by identifying long- and short-term debt, in addition to debt financing from outside and inside creditors. We find that long-term debt financing from outside creditors positively affects the likelihood of bankruptcy but negatively affects the likelihood of voluntary liquidation and merger. However, short-term debt financing from outside creditors does not affect the likelihood of bankruptcy, although it has a positive and significant effect on the likelihood of voluntary liquidation. Furthermore, while the likelihood of voluntary liquidation and exit via merger is not associated with macroeconomic conditions, the likelihood of bankruptcy is negatively associated with them, suggesting that the bankruptcy of start-up firms is more likely to occur during recessionary periods.

This study contributes to the existing literature in several ways. First, it provides evidence on which types of debt financing—specifically, debt financing from outside creditors (i.e., banks and other financial institutions) versus inside creditors (i.e., board members and affiliated firms) and long- versus short-term debt financing—influence start-up firms' survival and exit. Indeed, initial financial conditions influence firm survival and exit in the early stages (Honjo and Kato, 2019; Huynh et al., 2012). Although initial debt financing is expected to affect post-entry performance, it is unclear which types of debt financing determine their survival and exit. In particular, the effect of initial debt financing from outside creditors on firm survival differs from that of initial debt financing from inside creditors;

however, only a few studies have identified differences in firm survival (Cole and Sokolyk, 2018).[1] We provide new evidence that long-term debt financing from outside creditors rather than short-term debt financing affects start-up firms' survival and exit, suggesting that establishing relationships with outside creditors through long-term debt is more likely to determine post-entry performance. Second, this study demonstrates the different effects of debt financing on start-up firms' exit routes. While long-term debt financing from outside creditors increases the likelihood of bankruptcy, it impedes voluntary liquidation. These findings suggest that the long-term lending relationships with financial institutions, such as banks, influence firms' exit routes, forcing them to lose exit routes other than bankruptcy. Moreover, the findings on exit via merger provide novel evidence that debt financing from outside creditors hinders shareholders' sellout strategies (i.e., exit strategies). Third, we show that the impact of initial financial conditions on firm survival persists over time. Since start-up performance depends on a firm's growth cycle, we track firm survival during a certain period to identify the impact of debt financing. Geroski et al. (2010) identified persistence in the impact of initial conditions, specifically firm size, for at least ten years after founding. However, there is a paucity of research on the impact of initial financial conditions. Thus, we provide evidence on whether the impact of initial debt financing on firm survival persists over time by tracing exit routes for more than ten years. Furthermore, we examine the impact of current debt financing, in addition to initial debt financing, on firm survival, considering that the degree of dependence on debt financing varies over time.

The remainder of this paper is organized as follows. Section 2 discusses the research background and provides a literature review. Section 3 describes the methods used in this study. Section 4 explains the data and Section 5 presents our estimation results. Finally, we conclude our findings.

2 Literature review and hypothesis development

2.1 Initial funding

[1] Honjo and Kato (2019) estimated the determinants of exit routes using the sample of start-up firms and found that equity financing increases the likelihood of firm survival under unregulated conditions. However, they did not identify the type of debt, including debt from outside and inside creditors.

The importance of firms' initial conditions (i.e., founding conditions) has been highlighted in the literature (Ayyagari et al., 2017; Garud et al., 2010). Initial conditions impose certain restrictions on firms' future, including their expectations (Hurwicz, 1946). The effects of initial conditions may persist over time because strategic decisions involve deploying resources that cannot be replaced later (Geroski et al., 2010). Especially for innovative start-ups, initial conditions, specifically initial technological knowledge, may determine firm performance (Minola et al., 2021).

Numerous scholars have addressed initial funding (synonymously, start-up financing) in the literature (Block et al., 2018; Cumming et al., 2019; Cumming and Groh, 2018; Denis, 2004; Nofsinger and Wang, 2011).[2] Many start-up firms rely on external financing because of entrepreneurs' limited funds. Initial funding involves access to external capital, which is often required for firm growth in the early stages. Initial financial conditions, including access to external financing, may determine post-entry performance, given that they impose restrictions on the future of firms. In addition, the effects of initial financial conditions on firm performance may persist over time (Huynh et al., 2012). Thus, improving initial financial conditions has proven effective for firm survival.

Previous studies emphasize the role of debt financing, typically bank loans, in business start-ups (Bolton and Freixas, 2000; Deloof et al., 2019; Robb and Robinson, 2014). Debt financing is useful for filling the gap in the demand for initial funds. Moreover, debt financing in the early stages helps establish future lending relationships. Therefore, lending relationships may affect firm performance in later stages. Especially in economies with bank-centered financing systems, such as Japan, start-up firms are more likely to rely on debt financing (Honjo, 2021). In such economies, debt financing may be critical for improving start-up firm performance.[3]

2.2 Types of debt financing

[2] Some scholars have highlighted the capital structure of start-up firms (Cassar, 2004; Coleman et al., 2016; Honjo, 2021; La Rocca et al., 2011).

[3] Suzuki (2012) provided evidence that small banks play a role in reducing the bankrupt rate of small firms in Japan; however, the sample used was not start-up firms.

It is often argued that the use of bank loans is associated with firm survival (Åstebro and Bernhardt, 2003). Some scholars emphasize that a higher level of debt financing is associated with faster revenue and employment growth (Cosh et al., 2009; Robb and Robinson, 2014). Interestingly, Cole and Sokolyk (2018) found that debt obtained in the name of firms is associated with firm survival, whereas debt obtained in the name of firm owners is not. This finding suggests that the effect of initial debt financing from outside creditors differs from that of initial debt financing from inside creditors. Moreover, long-term debt compensates for a lack of capital, whereas short-term debt is usually used for bridge financing (Kahl et al., 2015). Therefore, the role of short-term debt may differ from that of long-term debt. However, to the best of our knowledge, no studies have examined the impact of debt financing on exit routes among start-up firms by identifying the type of debt, such as debt from outside and inside creditors, or long- and short-term debt. It is plausible that debt financing affects firm survival, depending on the type of debt.

Debt financing is associated with the success of younger firms in terms of survival and revenue growth (Cole and Sokolyk, 2018). This is because lenders select high-quality firms from among start-up firms to provide initial funds. However, even if lenders focus on providing funds to high-quality firms, they do not necessarily select such firms due to information asymmetries with entrepreneurs. Adverse selection and moral hazard problems are more prevalent in initial funding (Huyghebart and Van de Gucht, 2004). It is also likely that high-quality firms that can secure sufficient equity capital to start businesses do not rely on debt financing. Additionally, even if debt financing fills the capital gap, interest payments on debt capital may unexpectedly burden start-up firms. Conversely, equity financing is more effective for firm survival than debt financing (Honjo and Kato, 2019). Thus, debt financing may increase the likelihood of bankruptcy (Deloof and Vanacker, 2018). However, whether initial debt financing improves firm performance remains uncertain.

Furthermore, some scholars emphasize the differences between long- and short-term debt financing (Leland and Toft, 1996). Long-term debt enables start-up firms to increase capital and reinforce their lending relationships with financial institutions, such as banks, in a firm's growth cycle. Conversely, short-term debt allows financially constrained firms to raise funds for bridge financing (Kahl et al., 2015). Despite information asymmetries with entrepreneurs, financial institutions are willing to select

high-quality firms and provide them with debt capital from a long-term perspective. Although it is conceivable that the impact of long-term debt differs from that of short-term debt, few studies have examined the impact of long-term debt on the survival of start-up firms (Castaldo et al., 2023). Therefore, further investigations are warranted.

2.3 Types of exits routes

Firm growth is expected to spur economic growth, and start-up firms are considered engines of innovation and growth (Biancalani et al., 2022). However, entrepreneurs often encounter difficulties in raising initial funds; in other words, financial constraints occur in initial funding. Financial constraints are particularly severe for young and small firms (Carreira and Silva, 2010). Some firms become extinct due to unprofitability without achieving business expansion. Therefore, entrepreneurs seek sustainability after launching a business, and survival is a prerequisite for business expansion.

Numerous scholars have examined the determinants of new firm survival (Audretsch and Mahmood, 1995; Mata et al., 1995). However, these studies ignored exit routes. Unlike these studies, several scholars have shed light on the differences between exit routes (Harhoff et al., 1998; Schary, 1991). Some studies identify three exit routes: bankruptcy (failure), voluntary liquidation (closure), and merger (Balcaen et al., 2012; Cefis et al., 2023; Coad and Kato, 2021; Kato and Honjo, 2015; Kato et al., 2022).[4] In particular, firms that rely on debt financing are forced to go bankrupt by default unless outside creditors allow them to delay payments. Conversely, firms that do not rely on debt financing can choose to liquidate voluntarily. Moreover, fast-growing start-ups may achieve a successful exit by selling them to acquirers. Typically, serial entrepreneurs seek opportunities to exit through mergers and acquisitions (M&A) (Cotei and Farhat, 2018). Several studies highlight how exit via merger differs from other exit routes, including bankruptcy (Cefis and Marsili, 2011; Grilli, 2011; Grilli et al., 2010).

As exit routes are not homogeneous across firms, firm strategy and performance vary according to the type of exit routes, such as bankruptcy or merger. Regarding the determinants of exits, the effects of

[4] Cefis and Marsili (2012) also captured restructuring, in addition to failure (including bankruptcy and voluntary liquidation) and M&A. For more studies on firm exit, see Cefis et al. (2022).

firm size and age on exit routes have been explored (Coad and Kato, 2021). In addition to firm size and age, founders' human capital (Grilli, 2011; Kato and Honjo, 2015) and legal forms, such as sole proprietorships and partnerships (Grilli et al., 2010), have been investigated. These findings suggest that exit routes vary across start-up firms. Moreover, given the importance of financing, some studies have examined the impact of financial constraints on exit routes (Ponikvar et al., 2018). It is plausible that initial funding, which is inevitable when a founder launches a business, determines the path to growth in a firm's lifecycle. From the path dependence perspective, initial financial conditions, such as debt and equity financing, may dominate exit routes (Honjo, 2021; Honjo and Kato, 2019). In particular, the use of initial debt financing may affect the choice of exit routes through relationships with creditors. In the following section, we present and test our hypotheses on the impact of debt financing on exit routes.

2.4 Hypothesis development

While inside creditors, including entrepreneurs and their families, provide certain amounts of funds, outside creditors, such as banks and other financial institutions, can provide large amounts of funds to firms. Start-up firms expect financial institutions, such as banks, to secure funding for business expansion. In particular, start-up firms with growth potential may seek close relationships with financial institutions. However, if start-up firms raise initial funds through debt financing from outside creditors, they are more likely to encounter difficulties in sustaining their businesses because of the burden of interest payments in the early stages. Start-up firms that rely on debt financing from outside creditors are more likely to go bankrupt because they are forced to go bankrupt by default unless outside creditors allow them to delay payments. Conversely, given that inside creditors are more likely to permit delayed payments, debt financing from inside creditors does not have as significant an impact as debt financing from outside creditors. Moreover, lending and borrowing long-term debt, unlike short-term debt, builds close relationships with financial institutions, such as banks, which may increase the impact of debt financing on the likelihood of bankruptcy. In this study, we test the following hypothesis:

H1: Start-up firms that raise debt financing from outside creditors are more likely to exit due to bankruptcy.

Start-up firms that do not rely on initial funds through debt financing from outside creditors, such as banks and other financial institutions, are less likely to encounter difficulties in sustaining their businesses because of a lack of interest payments. Such firms may make their own decisions about whether to liquidate without interference from outside creditors. Despite the lack of access to external capital, these firms are more likely to avoid bankruptcy when encountering difficulties in sustaining their businesses. Although these firms have few growth opportunities, they can choose voluntary liquidation because of their tenuous relationships with outside creditors. Conversely, lending relationships with outside creditors may preclude the choice of voluntary liquidation, and start-up firms that rely heavily on debt capital cannot easily choose voluntary liquidation. Thus, we posit the following hypothesis:

H2: Start-up firms that raise debt financing from outside creditors are less likely to liquidate voluntarily.

Undoubtedly, merger differs substantially from bankruptcy and voluntary liquidation. This is because merger partially includes a successful exit. Some start-up firms with growth potential attract acquires (investors) who are willing to gain more firm control than current lenders. Firms that initially rely on equity financing may seek equity financing, rather than debt financing, for business expansion and are more likely to be targeted as merger candidates (Honjo and Kato, 2019). Conversely, firms that initially rely on debt financing from outside creditors do not necessarily seek equity capital, because they have more opportunities to access debt capital. In other words, start-up firms that rely on debt financing may lack the opportunities to exit via merger. Close relationships with financial institutions, such as banks, may prevent start-up firms from raising funds from private equity capital. Thus, we propose the following hypothesis:

H3: Start-up firms that raise debt financing from outside creditors are less likely to exit via merger.

3 Data and methods

3.1 Data sources

The sample used in the estimation was extracted from a database compiled by Teikoku Databank, Ltd.

(TDB), a major credit investigation company in Japan. We constructed our sample, based on company profiles compiled by TDB, called COSMOS2 as the product name.[5] Our sample contained information on firm exits, such as failures (bankruptcies) and mergers, using the data sources: *Tosan File* (Bankruptcy File) and *Sakujo File* (Deletion File). We also added firms' financial statements compiled by TDB, called COSMOS1 as the product name, to our sample. Moreover, we used a database compiled by the Cabinet Office to obtain data on the real growth rate of gross domestic product (GDP).[6]

We target joint-stock companies, which are the most typical legal form in Japan, mainly because the TDB database covers the financial statements of joint-stock companies, compared to other legal forms such as limited partnerships. We select firms in the manufacturing, transportation and telecommunications, wholesale and retail trade (including restaurants), and services sectors. The sample consists of joint-stock companies incorporated between 1998 and 2010.[7] The observation period for exits ranges from the firm's founding year to December 2021. By doing so, we can observe the exits of firms with more than ten years.

Several firms were excluded from the sample. First, exits with only one-year observation were excluded because we used a one-year lag to identify the impact of debt financing on the likelihood of exit. Second, firms without financial statements in the first accounting year (more precisely, the following year after founding) or during any observation year were excluded. Third, only one firm with negative total capital, defined as equity financing plus debt financing, was excluded. Fourth, only a few extremely large firms were included; specifically, firms with capital stock (stated capital) of 1 billion JPY or more in the first accounting year were excluded as outliers. Furthermore, observations before

[5] Although COSMOS2 is stored every December, the most recent version of COSMOS2 does not cover past information. Therefore, we constructed our data set by combining the past versions of COSMOS 2. We also used the last versions of *Tosan File* (Bankruptcy File) and *Sakujo File* (Deletion File).

[6] We accessed the Cabinet Office website and downloaded a file of GDP (expenditure approach) and its components (type: percent change, real, and calendar year).

https://www.esri.cao.go.jp/en/sna/data/sokuhou/files/2023/qe233_2/gdemenuea.html [accessed on January 31, 2024].

[7] This study targets firms that incorporated in and after 1998 because COSMOS1 reports financial statements from August 1998.

founding years and after exit were excluded.[8]

3.2 Sample

Table 1 presents the distribution of exits in the sample. The sample used in this study consists of 6,142 firms. Among these, 2,736 firms exited by December 2021. Of the 2,736 exits, 483 firms went bankrupt, 644 firms liquidated voluntarily, and 512 firms were acquired through mergers. Although the reasons for these exits were identified, others, including address changes, could not be identified; that is, the remaining firms (i.e., 2,736 – 483 – 644 − 512 = 1,097 firms) exited for unspecified reasons. Table 1 presents the number of exits by firm age. As we focus on the impact of initial debt financing on exit routes, our sample is inevitably limited to firms for which financial statements in the first accounting year can be obtained from COSMOS1.

[Insert Table 1 about here]

The sample (6,142 firms) is classified into manufacturing (809 firms), transportation and telecommunications (295 firms), wholesale and retail trade (2,702 firms), and services (2,336 firms) sectors. The average number of employees in the first accounting year is 27, with a median of 8. As this study targets joint stock companies, the sample tends to consist of start-up firms of certain sizes. The median of the total amount of debt financing in the first accounting year is 10 million JPY. While the median of the amount of debt from outside creditors in the first accounting year is 9.8 million JPY, that from inside creditors is zero, indicating that start-up firms are more likely to use debt from outside creditors than debt from inside creditors. Moreover, while the median of long-term debt from outside creditors in the first accounting year is 0.48 million JPY, that of short-term debt is zero.

3.3 Methods

We employ a discrete-time duration model to identify the impact of debt financing on exit routes

[8] The founding years of some firms were changed during the observation period. In this case, we regard founding years last reported as the firms' founding years, and observations for the years before founding years and those after exit were excluded.

following previous studies (Cefis and Marsili, 2011, 2012; Kato and Honjo, 2015).[9] We consider whether firm i that survives in year t exits in the following year. Let T_{ij} denote firm i's time to exit route j. This study examines three exit routes: bankruptcy, voluntary liquidation, and merger. Let D_i denote firm i's debt financing in the first accounting year. The hazard function $h_{ij}(t)$, which represents the conditional probability of transition to exit route j, is expressed as follows:

$$h_{ij}(t) = \Pr\left(T_{ij} = t + 1 | T_{ij} > t\right) = F\left(\beta_{j1} D_i + \beta_{j2}^{T} X_{it} + \nu_i\right), \quad (4)$$

where X_{it} is a vector of controls affecting this probability, β_{j1} and β_{j2} (vector) are parameters to be estimated, ν_i represents a random-effects term, and $F(\cdot)$ is the cumulative function.

The estimation results indicate whether debt financing influences exit routes. Moreover, we employ a discrete-time duration model with an instrumental variable (IV) to account for the possible endogeneity in current debt financing.

3.4 Variables

The definitions of these variables are listed in Table 2. We capture initial funding using firms' financial statements obtained from COSMOS1. The liabilities section of financial statements includes various types of debt, such as trade credit and provision. To identify initial debt financing that reflects relationships with financial institutions, such as banks, we measure it using debt provided by outside creditors in the first accounting year. Although we cannot identify who provides debt to firms using financial statements, the variable of initial debt financing from outside creditors includes loans provided by banks. In practice, we use the ratio of debt finance to total capital and measure total capital by focusing only on accounts that represent firms' capital.[10]

[Insert Table 2 about here]

More importantly, we can distinguish outside creditors, such as banks and other financial institutions,

[9] Information services are included not in the transportation and telecommunications but in the services sector.

[10] Specifically, total capital consists of long- and short-term debt from outside creditors, long- and short-term debt from inside creditors, capital stock (stated capital), legal capital surplus, share warrants, and convertible and warrant bonds, but trade credit and provision are excluded. Net income after tax and retained earnings are also excluded.

from inside creditors, such as board members and affiliated firms. The variable of initial debt financing from inside creditors, in addition to outside creditors, is also included. We also measure both long- and short-term debt. As already mentioned, long-term debt compensates for the lack of a firm's capital, and short-term debt is used for bridge financing (Kahl et al., 2015). Rather, long-term debt financing plays a more critical role in raising initial funds and may represent current creditors' and potential investors' behavior.

Moreover, current conditions, rather than initial conditions, may affect firm survival and exit because learning and selection dynamics are present in a firm's growth cycle. (Geroski et al., 2010). To identify this effect, we use the variable of current debt financing (i.e., time-variant debt financing), in addition to initial debt financing. However, collecting data other than exit routes and initial values (i.e., initial debt financing) causes a time lag issue because data are not obtainable for all years from COSMOS1 and COSMOS2. In this study, we replace data only when they are obtained from COSMOS1 and COSMOS2; in other words, the variables obtained from COSMOS1 and COSMOS2, except for initial debt financing and firm age, may have a time lag with actual values.

Some of the variables are included as controls. Profitability may significantly affect the relationship between debt financing and firm survival because profits are a source of internal financing. Thus, profitability, measured by the ratio of net income after tax to total assets, is included in the model. In addition, a fixed assets rate is included to control the asset structure. Moreover, previous studies have focused on the survival of high-tech start-ups (Cefis and Marsili, 2011, 2012; Grilli, 2011; Kato and Honjo, 2015). Thus, we identify firms devoted to research and development (R&D) using a dummy for R&D expenditures and examine the differences in firm performance between high- and low-tech start-ups. These variables are obtained from COSMOS1. Furthermore, firm size and age are included in the model, which are obtained from COSMOS2. Finally, we measure macroeconomic conditions using the real growth rate of GDP.

Table 3 presents the descriptive statistics of the variables. Among these variables, initial debt financing (DEBT_OUT (initial), DEBT_IN (initial), L_DEBT_OUT (initial), and S_DEBT_OUT (initial)) is time-invariant, and current debt financing (DEBT_OUT, DEBT_IN, L_DEBT_OUT, and S_DEBT_OUT) and some controls (PROF/TA, FA/TA, D_RD, lnEMPL, lnAGE, and GDP) are time-

variant.

[Insert Table 3 about here]

4 Results

4.1 Debt financing from outside and inside creditors

Table 4 reports the average marginal effects of debt financing on the likelihood of all exit routes, which include bankruptcy, voluntary liquidation, and merger cases, in addition to exits for unspecified reasons. Columns (i), (ii), and (iii) present the results (average marginal effects) for all exit routes (exit) when initial debt financing from outside and inside creditors is used.[11] Column (ii) includes the variable of profitability to control for internal financing. Column (iii) presents the results obtained using the firm's current debt financing instead of initial debt financing.[12] Table 4 also reports those of bankruptcy, voluntary liquidation, and merger cases, respectively. In addition, columns (iv), (v), and (vi), columns (vii), (viii), and (ix), and columns (x), (xi), and (xii) report the results for bankruptcy, voluntary liquidation (liquidation), and merger, respectively. Overall, the results of initial debt financing from outside and inside creditors are robust irrespective of the inclusion of profitability in the models for all exit routes, bankruptcy, voluntary liquidation, and merger.

[Insert Table 4 about here]

As shown in columns (i) and (ii) of Table 4, initial debt financing from outside and inside creditors has a negative effect on the likelihood of all exit routes. We find that firms that initially rely on debt financing are more likely to exit the market. In column (iii), current debt financing from outside creditors also has a negative and significant effect on the likelihood of all exit routes. However, current debt financing from inside creditors has no significant effect.

Columns (iv) and (v) show that initial debt financing from outside creditors has a positive and significant effect on the likelihood of bankruptcy, while initial debt financing from inside creditors has

[11] We obtained similar results when using only DEBT_OUT (initial) or DEBT_IN (initial).

[12] Current debt financing, unlike initial debt financing, may be endogenously determined; therefore, we estimate a probit model with an instrumental variable in the Appendix.

no significant effect. The results reveal that firms that initially rely on debt financing from outside creditors are more likely to go bankrupt, partly because of the burden of interest payments in the early stages. Our results support H1. Column (vi) shows that current debt financing from outside creditors also has a positive and significant effect and that the average marginal effect of current debt financing is slightly higher than that of initial debt financing. The results reveal that debt financing increases the likelihood of bankruptcy, irrespective of initial or current debt financing. This suggests that equity financing is more effective than debt financing in improving business longevity. However, debt financing from inside creditors is not related to the likelihood of bankruptcy. These findings suggest that outside creditors, such as banks and other financial institutions, are involved in the likelihood of firm bankruptcy, while inside creditors, such as board members and affiliated firms, are not.

Conversely, as columns (vii) and (viii) show, initial debt financing from outside and inside creditors has a negative and significant effect on the likelihood of voluntary liquidation. Column (ix) shows that current debt financing from outside creditors has a negative and significant effect. We find that debt financing reduces the likelihood of voluntary liquidation. Our results support H2. Start-up firms that rely on debt financing from outside and inside creditors are less likely to liquidate voluntarily, while they are more likely to exit due to bankruptcy. These findings imply that start-up firms that do not raise initial funds through debt financing decide whether to liquidate without interference from outside or inside creditors.

Moreover, as columns (x), (xi), and (xii) show, initial debt financing from outside and inside creditors has a negative and significant effect on the likelihood of a merger. The results reveal that debt financing decreases the likelihood of a merger, indicating that start-up firms that rely on debt financing, irrespective of initial or current debt financing, are less likely to exit via merger. Our results support H3. Start firms that rely on debt financing may not attract private equity investors, such as venture capitalists and angel investors. Long-term debt may prevent start-up firms from undertaking exit strategies via M&A. From the path dependence perspective, initial debt financing may dominate exit routes other than M&A.

4.2 Long- and short-term debt financing

In Table 5, we demonstrate the average marginal effects of long-term debt financing on the likelihood of all exit routes, bankruptcy, voluntary liquidation, and merger, by focusing on long-term debt financing. Table 6 presents the average marginal effects of short-term debt financing. In line with Table 4, Tables 5 and 6 indicate whether long- and short-term debt financing influences the likelihood of all exit routes, bankruptcy, voluntary liquidation, and merger.

[Insert Tables 5 and 6 about here]

As shown in columns (i), (ii), and (iii) of Table 5, long-term debt financing from outside creditors has a negative effect on the likelihood of all exit routes, irrespective of initial or current debt financing, which is consistent with the results in Table 4. The results reveal that start-up firms that rely on long-term debt financing are less likely to exit the market. In contrast, as shown in columns (i), (ii), and (iii) of Table 6, short-term debt financing from outside creditors has a positive effect on all exit routes, although it is insignificant in column (ii). We find that firms that initially rely on short-term debt financing, which may represent bridge financing, are more likely to exit, contrary to those that initially rely on long-term debt financing. Start-up firms that use short-term debt financing eventually exit the market because short-term debt financing is solely bridge financing (Kahl et al., 2015).

In columns (iv), (v), and (vi) of Table 5, long-term debt financing from outside creditors has a positive and significant effect on the likelihood of bankruptcy. However, as shown in the columns of Table 6, short-term debt financing from outside creditors has no significant effect. These results indicate that long-term debt financing has a more significant effect on the likelihood of bankruptcy than short-term debt financing. It is plausible that long-term debt, which comprises a firm's capital, is more inevitable than short-term debt in terms of business longevity. However, start-up firms that rely on long-term debt financing are more likely to go bankrupt. This is due to the burden of interest payments. In addition, outside creditors may force bankruptcy on start-up firms without prospects for growth, despite long-term relationships with the firms.

Conversely, as shown in columns (vii), (viii), and (ix) of Table 5, long-term debt financing has a negative and significant effect on the likelihood of voluntary liquidation, irrespective of initial or current debt financing. The results reveal that start-up firms that rely on long-term debt financing, which tend to have relationships with outside creditors, are less likely to liquidate voluntarily. In contrast, as shown

in the columns of Table 6, short-term debt financing has a positive and significant effect on the likelihood of voluntary liquidation. The results suggest that start-up firms that rely on short-term debt financing eventually seek a voluntary exit, even though they struggle to secure working capital.

As shown in columns (x), (xi), and (xii) of Table 5, long-term debt financing has a negative and significant effect on the likelihood of a merger, irrespective of initial or current debt financing. However, as shown in these columns of Table 6, short-term debt financing has no significant effect on the likelihood of a merger. The results reveal that start-up firms that rely on long-term debt financing, unlike short-term debt financing, are less likely to exit via merger. These findings indicate that such firms are less likely to be targeted as merger candidates, which is consistent with Honjo and Kato (2019).

4.3 Other factors

The results for the controls are reported in Tables 4, 5, and 6. Profitability has a negative and significant effect on the likelihood of bankruptcy and voluntary liquidation but no significant effect on the likelihood of a merger. The results indicate that firms with higher profitability are less likely to go bankrupt or liquidate voluntarily. In addition, profitability is not associated with the likelihood of a merger, suggesting that exits via merger include not only successful but also unsuccessful cases. The fixed assets ratio has a positive and significant effect on the likelihood of bankruptcy, indicating that firms with tangible assets are more likely to go bankrupt. Moreover, the R&D dummy has no significant effect on the likelihood of bankruptcy, voluntary liquidation, and merger. We find no difference in firm survival between R&D intensive firms and others.

While firm size has a negative and significant effect on the likelihood of bankruptcy and voluntary liquidation, it has a positive and significant effect on the likelihood of a merger. The results reveal that although smaller firms are more likely to exit, they are less likely to become merger targets. Moreover, firm age has a positive and significant effect on the likelihood of bankruptcy and voluntary liquidation. These relationships contradict the notion that younger firms are more likely to exit the market. As the sample is limited to joint-stock companies that report financial statements, firms that can survive for a certain period may be the target of our survey.

Furthermore, macroeconomic conditions have a negative and significant effect on the likelihood of

bankruptcy but no significant effect on the likelihood of voluntary liquidation and merger. The results reveal that the likelihood of start-up firms going bankrupt is higher during recessionary periods, indicating that macroeconomic conditions affect bankruptcy in the exit routes of start-up firms. In contrast, voluntary liquidation and merger may occur regardless of macroeconomic conditions.

4.4 Discussion

In several economies, debt financing plays a prominent role in SME financing. In Japan, regional banks, *shinkin* banks (credit associations), and credit cooperatives have been established to provide funds to local SMEs, and various programs have facilitated the flow of funds for SME financing. As a result, debt financing has increased over time after firm founding in Japan (Honjo, 2021). Many potential entrepreneurs recognize that financing is one of the greatest obstacles in launching new businesses. However, some entrepreneurs are obliged to start firms with insufficient capital due to the limited access to capital markets. Therefore, policymakers and practitioners often emphasize the need for public support to improve initial funding conditions, which may promote successful new businesses. Moreover, public policies have been implemented to enhance debt financing for SMEs, including start-up firms, in these economies during recessionary periods.[13]

However, our findings suggest that debt financing increases the likelihood of bankruptcy after firm founding. Even if public support through debt financing is useful for promoting start-up firms, bankruptcy is unavoidable. Establishing close relationships with financial institutions, such as banks, through long-term debt financing may increase the likelihood of bankruptcy of start-up firms. Simultaneously, this may detract from other routes, such as exit via merger. Conversely, equity financing, including private equity capital, helps sustain new businesses. Relationship lending based on close ties to financial institutions, such as regional banks and government-affiliated financial institutions,

[13] Bank loans may become the most important source of initial funding during the financial crisis period (Deloof and Vanacker, 2018). In the case of Japan, the Japan Financial Corporation (JFC), a government-affiliated financial institution, has loan programs to promote these activities by providing a stable supply of long-term loans when the economy is stagnant. For instance, the JFC provided special concessional loans related to COVID-19 (Hoshi et al., 2023).

is prevalent in SME financing in economies with bank-centered financing systems, such as Japan (Ono and Uesugi, 2009; Tsuruta, 2023). However, we should understand the limitations of debt financing to start-up firm survival and refrain from excessive expectation of relationship lending.

Our findings contribute to the existing literature in several ways. As stated, Cole and Sokolyk (2018) found that debt obtained in the name of firms is associated with firm survival, while debt obtained in the name of firm owners has no effect. Although we use different data on how firms raise funds, we demonstrate differences in the impact of debt financing between outside creditors (i.e., banks and other financial institutions) and inside creditors (i.e., board members and affiliated firms). Our findings on the impact of long-term debt financing from outside creditors on the likelihood of all exit routes are consistent with those of Cole and Sokolyk (2018). However, our findings regarding the likelihood of bankruptcy, which are opposite to those of voluntary liquidation, are inconsistent with those of Cole and Sokolyk (2018). This highlights the need to identify exit routes when the effects of initial debt financing are examined. Furthermore, our findings suggest that long-term debt is more prominent for bankruptcy and merger than short-term debt, implying that initial long-term debt, although not the only way, determines the future route for start-up firms.

5 Conclusions

This study explores the impact of initial debt financing on the survival of start-up firms using a discrete-time duration model for Japanese start-up firms. We examine how debt financing affects the time from founding to exit, by identifying three types of exit routes: bankruptcy, liquidation, and merger. We find that firms that initially rely on debt financing from outside creditors are more likely to go bankrupt and that long-term debt, rather than short-term debt, is positively associated with the time to exit due to bankruptcy. In contrast, such firms are less likely to liquidate voluntarily, and long-term debt is negatively associated with the time to voluntary liquidation. Moreover, they are less likely to exit via merger, and long-term debt is negatively associated with the time to exit via merger. Unlike voluntary liquidation and merger, macroeconomic conditions influence the likelihood of bankruptcy.

This study has some limitations. First, we employ firms' financial statements in the first accounting year to identify initial funding. Although a time lag exists between the first accounting year and founding,

it is quite difficult to obtain financial statements at founding, which firms do not generally report to others. Moreover, firms whose financial statements are unavailable in the first accounting year are excluded from the sample.[14] It is also difficult to capture exits soon after firm founding and obtain financial statements. Appropriate correction of data on initial funding remains a challenge. Second, while initial debt financing is highlighted in this study, initial equity financing, specifically investment by venture capitalists and angel investors, is ignored because of a lack of data on shareholders and investments. Further investigations using these data are required.

Appendix

It is possible that current debt financing is endogenously determined. Therefore, we employ an IV probit model to consider potential endogeneity. The estimation results (estimated coefficients) using the IV probit are shown in Table A1. As a result, we obtain signs similar to those shown in Tables 4, 5, and 6 when current debt financing is endogenously determined.

[Insert Table A1 about here]

References

Åstebro, T., & Bernhardt, I. (2003). Start-up financing, owner characteristics, and survival. *Journal of Economics and Business, 55*, 303–319.

Audretsch, D. B., & Mahmood, M. (1995). New firm survival: New results using a hazard function. *Review of Economics and Statistics*, *77*(1), 97–103.

Ayyagari, M., Demirguc-Kunt, A., & Maksimovic, V. (2017). What determines entrepreneurial outcomes in emerging markets? The role of initial conditions. *Review of Financial Studies, 30*(7), 2478–2522.

Balcaen, S., Manigart, S., Buyze, J., & Ooghe, H. (2012). Firm exit after distress: Differentiating

[14] However, in practice, previous studies have used financial statements in the first accounting year to capture start-up firms' financial variables (Fuertes-Callén et al., 2022).

between bankruptcy, voluntary liquidation and M&A. *Small Business Economics, 39*, 949–975.

Berger, A. N., & Schaeck, K. (2011). Small and medium-sized enterprises, bank relationship strength, and the use of venture capital. *Journal of Money, Credit and Banking, 43*(2–3), 461–490.

Biancalani, F., Czarnitzki, D., & Riccaboni, M. (2022). The Italian Start Up Act: A microeconometric program evaluation. *Small Business Economics, 58*, 1699–1720

Block, J. H., Colombo, M. G., Cumming, D. J., & Vismara, S. (2018). New players in entrepreneurial finance and why they are there. *Small Business Economics, 50*, 239–250.

Bolton, P., & Freixas, X. (2000). Equity, bonds, and bank debt: Capital structure and financial market equilibrium under asymmetric information. *Journal of Political Economy, 108*(2), 324–351.

Carreira, C., & Silva, F. (2010). No deep pockets: Some stylized empirical results on firms' financial constraints. *Journal of Economic Surveys, 24*(4), 731–753.

Cassar, G. (2004). The financing of business start-ups. *Journal of Business Venturing, 19*(2), 261–283.

Castaldo, A., Pittiglio, R., Reganati, F., & Sarno, D. (2023). Access to bank financing and start-up resilience: A survival analysis across business sectors in a time of crisis. *Manchester School, 91*(3), 141–170.

Cefis, E., Bettinelli, C., Coad, A., & Marsili, O. (2022). Understanding firm exit: A systematic literature review. *Small Business Economics, 59*, 423–446.

Cefis, E., Coad, A., & Lucini-Paioni, A. (2023). Landmarks as lighthouses: Firms' innovation and modes of exit during the business cycle. *Research Policy, 52*(8), 104778.

Cefis, E., & Marsili, O. (2011). Born to flip. Exit decisions of entrepreneurial firms in high-tech and low-tech industries. *Journal of Evolutionary Economics, 21*, 473–498.

Cefis, E., & Marsili, O. (2012). Going, going, gone. Exit forms and the innovative capabilities of firms. *Research Policy, 41*(5), 795–807.

Coad, A., & Kato, M. (2021). Growth paths and routes to exit: 'shadow of death' effects for new firms in Japan. *Small Business Economics, 57*, 1145–1173.

Cole, R. A., & Sokolyk, T. (2018). Debt financing, survival, and growth of start-up firms. *Journal of Corporate Finance, 50*, 609–625.

Coleman, S., Cotei, C., & Farhat, J. (2016). The debt-equity financing decisions of U.S. startup firms.

Journal of Economics and Finance, 40, 105–126.

Cosh, A., Cumming, D. J., & Hughes, A. (2009). Outside entrepreneurial capital. *Economic Journal, 119*(540), 1494–1533.

Cotei, C., & Farhat, J. (2018). The M&A exit outcomes of new, young firms. *Small Business Economics, 50*, 545–567.

Cressy, R. (2002). Funding gaps: A symposium. *Economic Journal, 112*(477), F1–F16.

Cumming, D., Deloof, M., Manigart, S., & Wright, M. (2019). New directions in entrepreneurial finance. *Journal of Banking and Finance, 100*, 252–260.

Cumming, D., & Groh, A. P. (2018). Entrepreneurial finance: Unifying themes and future directions. *Journal of Corporate Finance, 50*, 538–555.

Deloof, M., La Rocca, M., & Vanacker, T. (2019). Local banking development and the use of debt financing by new firms. *Entrepreneurship Theory and Practice, 43*(6), 1250–1276.

Deloof, M., & Vanacker, T. (2018). The recent financial crisis, start-up financing and survival. *Journal of Business Finance and Accounting, 45*(7–8), 928–951.

Denis, D. J. (2004). Entrepreneurial finance: An overview of the issues and evidence. *Journal of Corporate Finance, 10*(2), 301–326.

Fuertes-Callén, Y., Cuellar-Fernández, B., & Serrano-Cinca, C. (2022). Predicting startup survival using first years financial statements. *Journal of Small Business Management, 60*(6), 1314–1350.

Garud, R., Kumaraswamy, A., & Karnøe, P. (2010). Path dependence or path creation? *Journal of Management Studies, 47*(4), 760–774.

Geroski, P. A., Mata, J., & Portugal, P. (2010). Founding conditions and the survival of new firms. *Strategic Management Journal, 31*(5), 510–529.

Grilli, L. (2011). When the going gets tough, do the tough get going? The pre-entry work experience of founders and high-tech start-up survival during an industry crisis. *International Small Business Journal, 29*(6), 626–647.

Grilli, L., Piva, E., & Rossi-Lamastra, C. (2010). Firm dissolution in high-tech sectors: An analysis of closure and M&A. *Economics Letters, 109*(1), 14–16.

Harhoff, D., Stahl, K., & Woywode, M. (1998). Legal form, growth and exit of West German firms—

Empirical results for manufacturing, construction, trade and service industries. *Journal of Industrial Economics, 46*(4), 453–488.

Honjo, Y. (2021). The impact of founders' human capital on initial capital structure: Evidence from Japan. *Technovation, 100*, 102191.

Honjo, Y., & Kato, M. (2019). Do initial financial conditions determine the exit routes of start-up firms? *Journal of Evolutionary Economics, 29*, 1119–1147.

Hoshi, T., Kawaguchi, D., & Ueda, K. (2023). Zombies, again? The COVID-19 business support programs in Japan. *Journal of Banking and Finance, 147*, 106421.

Hurwicz, L. (1946). Theory of the firm and of investment. *Econometrica, 14*(2), 109–136.

Huyghebart, N., & Van de Gucht, L. M. (2004). Incumbent strategic behavior in financial markets and the exit of entrepreneurial start-ups. *Strategic Management Journal, 25*(7), 669–688.

Huynh, K. P., Petrunia, R. J., & Voia, M. (2012). Initial financial conditions, unobserved heterogeneity and the survival of nascent Canadian manufacturing firms. *Managerial and Decision Economics, 33*(2), 109–125

Kahl, M., Shivdasani, A., & Wang, Y. (2015). Short-term debt as bridge financing: Evidence from the commercial paper market. *Journal of Finance, 70*(1), 211–255.

Kato, M., & Honjo, Y. (2015). Entrepreneurial human capital and the survival of new firms in high- and low-tech sectors. *Journal of Evolutionary Economics, 25*, 925–957.

Kato, M., Onishi, K., & Honjo, Y. (2022). Does patenting always help new firm survival? Understanding heterogeneity among exit routes. *Small Business Economics, 59*, 449–475.

La Rocca, M., La Rocca, T., & Cariola, A. (2011). Capital structure decisions during a firm's life cycle. *Small Business Economics, 37*, 107–130.

Leland, H. L., & Toft, K. B. (1996). Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads. *Journal of Finance, 51*(3), 987–1019.

Mata, J., Portugal, P., & Guimarães, P. (1995). The survival of new plants: Start-up conditions and post-entry evolution. *International Journal of Industrial Organization, 13*(4), 459–481.

Minola, T., Hahn, D., & Cassia, L. (2021). The relationship between origin and performance of innovative start-ups: The role of technological knowledge at founding. *Small Business Economics,*

56, 553–569.

Nofsinger, J. R., & Wang, W. (2011). Determinants of start-up firm external financing worldwide. *Journal of Banking and Finance, 35*(9), 2282–2294.

Ono, A., & Uesugi, I. (2009). Role of collateral and personal guarantees in relationship lending: Evidence from Japan's SME loan market. *Journal of Money, Credit and Banking, 41*(5), 935–960.

Persson, H. (2004). The survival and growth of new establishments in Sweden, 1987–1995. *Small Business Economics, 23*, 423–440.

Ponikvar, N., Kejžar, K., Z., & Peljhan, D. (2018). The role of financial constraints for alternative firm exit modes. *Small Business Economics, 51*, 85–105.

Robb, A. M., & Robinson, D. T. (2014). The capital structure decisions of new firms. *Review of Financial Studies, 27*(1), 153–179.

Schary, M. A. (1991). The probability of exit. *RAND Journal of Economics, 22*(3), 339–353.

Suzuki, K. (2012). Bankruptcies of small firms and lending relationship. *Journal of Banking and Finance, 36*(3), 857–870.

Tsuruta, D. (2023). Bank loans, trade credit, and liquidity shortages of small businesses during the global financial crisis. *International Review of Financial Analysis, 90*, 102905.

Vivarelli, M. (2013). Is entrepreneurship necessarily good? Microeconomic evidence from developed and developing countries. *Industrial and Corporate Change, 22*(6), 1453–1459.

Table 1 Survival and exits by exit routes

Firm age	Survival	Exit	Bankruptcy	Liquidation	Merger	Others
1	6142					
2	6122	20	2	7	5	6
3	5943	179	29	52	46	52
4	5647	296	57	70	61	108
5	5318	329	74	78	44	133
6	5052	266	43	73	37	113
7	4837	215	44	42	36	93
8	4637	200	32	52	36	80
9	4406	231	44	60	38	89
10+	3406	1000	158	210	209	423
Total		2736	483	644	512	1097

Notes: The number of firms is 6,142. The total number of observations is 70,594.

Table 2 Definitions of variables

Variable	Symbol	Definition
Exit		(=1) if the firm exits, and (=0) otherwise.
Bankruptcy		(=1) if the firm goes bankrupt, and (=0) otherwise.
Liquidation		(=1) if the firm liquidates voluntarily, and (=0) otherwise.
Merger		(=1) if the firm exits via merger, and (=0) otherwise.
Total capital		Equity finance plus debt finance.
Equity finance		Sum of capital stock (stated capital), legal capital surplus, share warrants, and convertible and warrant bonds.
Debt finance		Long- and short-term debt from outside creditors, plus long- and short-term debt from inside creditors (board members, employees, affiliated firms, and controlling shareholders).
Long-term debt from outside creditors		Sum of long-term loans payable to outside creditors and corporate bonds.
Short-term debt from outside creditors		Sum of short-term loans payable to outside creditors and commercial papers.
Ratio of debt from outside creditors	DEBT_OUT	Long- and short-term debt from outside creditors, divided by total capital.
Ratio of debt from inside creditors	DEBT_IN	Long- and short-term debt from inside creditors (board members, employees, affiliated firms, and controlling shareholders), divided by total capital.
Ratio of long-term debt from outside creditors	L_DEBT_OUT	Long-term debt from outside creditors, divided by total capital.
Ratio of short-term debt from outside creditors	S_DEBT_OUT	Short-term debt from outside creditors, divided by total capital.
Profit rate	PROF/TA	Net income after tax, divided by total assets.
Fixed assets ratio	FA/TA	Fixed assets divided by total assets.
R&D	D_RD	(=1) if the firm reports R&D expenditures.
Firm size	lnEMPL	Logarithm of the number of employees plus one.
Firm age	lnAGE	Logarithm of the number of years from the firm's incorporation year.
Industry dummies	I_MANUF	(=1) for manufacturing.
	I_COMM	(=1) for transportation and telecommunications.
	I_TRADE	(=1) for wholesale and retail trade (including restaurants).
	I_SERV	(=1) for services, including information services.
Macroeconomic conditions	GDP	Real growth rate of gross domestic products.

Notes: All dummy variables take a value of one if the stated condition holds, and zero otherwise. Variables based on financial data are constructed from unconsolidated financial statements. The ratios of debt from outside and inside creditors (DBET_OUT and DEBT_IN) and those of long- and short-term debt from outside creditors (L_DEBT_OUT and S_DEBT_OUT) are also measured in the initial (first accounting) year. The reference category for the industry dummies is services.

Table 3 Descriptive statistics of variables

Variable	Mean	SD	p25	Median	p75
(Initial: N = 6142)					
DEBT_OUT (initial)	0.461	0.362	0.000	0.512	0.800
DEBT_IN (initial)	0.022	0.111	0.000	0.000	0.000
L_DEBT_OUT (initial)	0.278	0.331	0.000	0.022	0.574
S_DEBT_OUT (initial)	0.183	0.275	0.000	0.000	0.297
(Current: N = 70594)					
DEBT_OUT	0.561	0.360	0.203	0.683	0.879
DEBT_IN	0.018	0.096	0.000	0.000	0.000
L_DEBT_OUT	0.386	0.397	0.000	0.369	0.717
S_DEBT_OUT	0.176	0.263	0.000	0.006	0.280
PROF/TA	−0.047	0.620	−0.001	0.013	0.055
FA/TA	0.245	0.227	0.064	0.170	0.372
D_RD	0.130	-----	-----	-----	-----
lnEMPL	2.508	1.275	1.609	2.303	3.296
Number of employees	35.3	122	4	9	26
lnAGE	1.956	0.650	1.386	2.079	2.485
GDP	0.005	0.022	0.000	0.014	0.017

Notes: N indicates the number of observations.

Table 4 Estimation results: discrete-time duration models

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
	Exit	Exit	Exit	Bankruptcy	Bankruptcy	Bankruptcy	Liquidation	Liquidation	Liquidation	Merger	Merger	Merger
Variable	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx
DEBT_OUT (initial)	−0.026***	−0.023***		0.011***	0.011***		−0.006***	−0.009***		−0.006***	−0.006***	
	(0.007)	(0.007)		(0.003)	(0.003)		(0.002)	(0.003)		(0.001)	(0.001)	
DEBT_IN (initial)	−0.067***	−0.057***		0.005	0.005		−0.017**	−0.024**		−0.010**	−0.010**	
	(0.022)	(0.022)		(0.008)	(0.007)		(0.007)	(0.011)		(0.005)	(0.005)	
DEBT_OUT			−0.029***			0.014***			−0.014***			−0.009***
			(0.006)			(0.003)			(0.003)			(0.002)
DEBT_IN			−0.013			0.004			−0.014			0.002
			(0.021)			(0.006)			(0.009)			(0.004)
PROFIT/TA		−0.012***			−0.002***			−0.003***			-3.5×10^{-4}	
		(0.002)			(0.001)			(0.001)			(0.001)	
FA/TA	0.038***	0.035***	0.042***	0.011***	0.010***	0.005**	0.002	0.001	0.004	0.002	0.002	0.004**
	(0.009)	(0.009)	(0.009)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
D_RD	−0.003	−0.002	−0.003	0.001	0.001	0.001	−0.001	−0.002	−0.002	−0.002	−0.002	−0.002
	(0.006)	(0.006)	(0.006)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
lnEMPL	−0.020***	−0.017***	−0.019***	−0.002***	−0.002***	−0.001**	−0.006***	−0.009***	−0.009***	0.003***	0.004***	0.004***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
lnAGE	0.135***	0.104***	0.125***	0.011***	0.010***	0.004*	0.008***	0.019***	0.017***	0.002*	0.002*	0.003**
	(0.009)	(0.012)	(0.011)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
GDP	−0.018	−0.043	−0.028	−0.062***	−0.060***	−0.053***	0.020	0.029	0.026	−0.012	−0.012	−0.011
	(0.051)	(0.053)	(0.053)	(0.022)	(0.021)	(0.018)	(0.023)	(0.028)	(0.027)	(0.016)	(0.016)	(0.016)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant term	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594
Number of firms	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142
Log likelihood	−11410	−11405	−11412	−2853	−2848	−2828	−3581	−3574	−3573	−2935	−2935	−2918
Wald test (zero coefficients)	174***	130***	138***	68.0***	64.5***	73.6***	116***	110***	96.5***	113***	114***	133***
LR test ($\rho = 0$)	174***	143***	168***	16.9***	19.2***	8.16***	18.9***	17.9***	15.0***	3.46**	3.48**	6.90***

Notes: All columns show average marginal effects. Figures in parentheses are standard errors. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Table 5 Estimation results for the impact of long-term debt financing: discrete-time duration models

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
	Exit	Exit	Exit	Bankruptcy	Bankruptcy	Bankruptcy	Liquidation	Liquidation	Liquidation	Merger	Merger	Merger
Variable	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx
L_DEBT_OUT (initial)	−0.037***	−0.034***		0.012***	0.012***		−0.016***	−0.015***		−0.009***	−0.009***	
	(0.007)	(0.008)		(0.003)	(0.003)		(0.004)	(0.004)		(0.002)	(0.002)	
L_DEBT_OUT			−0.046***			0.003***			−0.020***			−0.011***
			(0.006)			(0.001)			(0.003)			(0.002)
PROF/TA		−0.012***			−0.002***			−0.003***			-3.0×10^{-4}	
		(0.002)			(0.001)			(0.001)			(0.001)	
FA/TA	0.042***	0.038***	0.048***	0.009***	0.009***	0.011***	0.004	0.003	0.007*	0.003*	0.003*	0.005***
	(0.009)	(0.009)	(0.009)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
D_RD	−0.003	−0.003	−0.003	0.001	0.002	0.001	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002
	(0.006)	(0.006)	(0.006)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
lnEMPL	−0.018***	−0.016***	−0.019***	−0.002**	−0.002**	−0.002**	−0.010***	−0.009***	−0.009***	0.003***	0.003***	0.003***
	(0.002)	(0.003)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
lnAGE	0.113***	0.103***	0.120***	0.009***	0.010***	0.008***	0.019***	0.018***	0.017***	0.002*	0.002*	0.003**
	(0.011)	(0.019)	(0.011)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
GDP	−0.037	−0.046	−0.032	−0.061***	−0.061***	−0.060***	0.028	0.028	0.027	−0.012	−0.012	−0.011
	(0.054)	(0.054)	(0.053)	(0.021)	(0.021)	(0.021)	(0.028)	(0.028)	(0.027)	(0.016)	(0.016)	(0.016)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant term	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594
Number of firms	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142
Log likelihood	−11415	−11407	−11398	−2850	−2846	−2858	−3576	−3570	−3559	−2927	−2927	−2909
Wald test (zero coefficients)	124***	75.7***	145***	57.7***	69.9***	48.3***	110***	112***	106***	120***	120***	143***
LR test ($\rho = 0$)	156***	132***	168***	16.7***	18.8***	4.19**	18.0***	16.1***	16.0***	3.84**	3.87**	5.92***

Notes: All columns show average marginal effects. Figures in parentheses are standard errors. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Table 6 Estimation results for the impact of short-term debt financing: discrete-time duration models

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
	Exit	Exit	Exit	Bankruptcy	Bankruptcy	Bankruptcy	Liquidation	Liquidation	Liquidation	Merger	Merger	Merger
Variable	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx	dF/dx
S_DEBT_OUT (initial)	0.015*	0.014*		−0.001	−0.001		0.008**	0.007**		0.002	0.002	
	(0.009)	(0.008)		(0.003)	(0.003)		(0.004)	(0.004)		(0.001)	(0.001)	
S_DEBT_OUT			0.027***			0.001			0.009***			0.001
			(0.008)			(0.003)			(0.003)			(0.001)
PROF/TA		−0.012***			−0.002***			−0.003***			-4.0×10^{-4}	
		(0.002)			(0.001)			(0.001)			(0.001)	
FA/TA	0.034***	0.030***	0.033***	0.012***	0.011***	0.012***	-1.5×10^{-4}	−0.001	-7.5×10^{-5}	4.2×10^{-4}	3.8×10^{-4}	3.9×10^{-4}
	(0.009)	(0.009)	(0.009)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.002)
D_RD	−0.003	−0.003	−0.003	0.001	0.001	0.001	−0.002	−0.002	−0.002	−0.002	−0.002	−0.002
	(0.006)	(0.006)	(0.006)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
lnEMPL	−0.018***	−0.017***	−0.021***	−0.002**	−0.002**	−0.002***	−0.010***	−0.009***	−0.010***	0.004***	0.004***	0.004***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
lnAGE	0.115***	0.104***	0.155***	0.008***	0.009***	0.009***	0.018***	0.018***	0.019***	0.002*	0.002*	0.002*
	(0.021)	(0.012)	(0.009)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
GDP	−0.037	−0.043	−0.001	−0.060***	−0.060***	−0.061***	0.029	0.029	0.030	−0.012	−0.012	−0.012
	(0.055)	(0.054)	(0.047)	(0.020)	(0.020)	(0.021)	(0.028)	(0.028)	(0.028)	(0.016)	(0.016)	(0.016)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant term	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594
Number of firms	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142
Log likelihood	−11430	−11411	−11411	−2863	−2859	−2863	−3585	−3579	−3583	−2950	−2950	−2951
Wald test (zero coefficients)	48.8***	121***	192***	42.6***	51.7***	47.4***	98.7***	101***	108***	96.9***	97.2***	97.0***
LR test ($\rho = 0$)	150***	147***	181***	15.3***	17.3***	15.5***	18.5***	16.9***	20.1***	3.37**	3.42**	3.27**

Notes: All columns show average marginal effects. Figures in parentheses are standard errors. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively.

Table A1 Estimation results: IV probit models

Variable	(i) Exit Coef.	(ii) Exit Coef.	(iii) Exit Coef.	(iv) Bankruptcy Coef.	(v) Bankruptcy Coef.	(vi) Bankruptcy Coef.	(vii) Liquidation Coef.	(viii) Liquidation Coef.	(ix) Liquidation Coef.	(x) Merger Coef.	(xi) Merger Coef.	(xii) Merger Coef.
DEBT_OUT	−0.128***			0.405***			−0.167**			−0.381***		
	(0.042)			(0.078)			(0.071)			(0.079)		
L_DEBT_OUT		−0.243***			0.409***			−0.369***			−0.632***	
		(0.047)			(0.077)			(0.083)			(0.098)	
S_DEBT_OUT			0.125**			−0.039			0.204**			0.125
			(0.056)			(0.104)			(0.094)			(0.107)
FA/TA	0.224***	0.274***	0.193***	0.196***	0.137*	0.292***	0.080	0.159**	0.041	0.173**	0.290***	0.034
	(0.040)	(0.041)	(0.038)	(0.072)	(0.076)	(0.067)	(0.072)	(0.074)	(0.071)	(0.081)	(0.084)	(0.078)
D_RD	−0.004	−0.005	−0.004	0.035	0.033	0.028	−0.021	−0.023	−0.021	−0.067	−0.064	−0.068
	(0.026)	(0.026)	(0.026)	(0.049)	(0.048)	(0.048)	(0.046)	(0.047)	(0.046)	(0.049)	(0.049)	(0.048)
lnEMPL	−0.059***	−0.061***	−0.061***	−0.040***	−0.031**	−0.034***	−0.142***	−0.144***	−0.147***	0.140***	0.133***	0.143***
	(0.007)	(0.007)	(0.008)	(0.013)	(0.012)	(0.012)	(0.014)	(0.013)	(0.014)	(0.012)	(0.012)	(0.012)
lnAGE	0.096***	0.103***	0.091***	−0.007	−0.008	0.013	0.059***	0.072***	0.055***	0.060**	0.079***	0.046*
	(0.012)	(0.012)	(0.012)	(0.021)	(0.021)	(0.021)	(0.021)	(0.021)	(0.020)	(0.024)	(0.024)	(0.023)
GDP	−0.609	−0.607	−0.591	−2.160***	−2.193***	−2.210***	0.490	0.502	0.519	−0.476	−0.456	−0.480
	(0.409)	(0.409)	(0.409)	(0.744)	(0.737)	(0.737)	(0.734)	(0.736)	(0.730)	(0.733)	(0.727)	(0.732)
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant term	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594	70594
Number of firms	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142	6142
Log pseudolikelihood	−18540	−33540	−1065	−9874	−24912	7567	−10624	−25626	6844	−9960	−24965	7488
Wald test (zero coefficients)	144***	161***	136***	68.4***	72.3***	40.8***	136***	145***	128***	202***	229***	198***
Wald test (exogeneity)	0.30	2.28	0.07	1.15	7.75***	0.51	1.40	0.08	0.60	0.08	4.17**	1.08

Notes: All columns show estimated coefficients. Figures in parentheses are standard errors adjusted for 6,142 clusters. ***, **, and * indicate 1%, 5%, and 10% significance levels, respectively. DEBT_OUT, L_DEBT, and S_DEBT are endogenously determined, and the initial values of DEBT, L_DEBT, and S_DEBT are used as instruments.