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Do initial financial conditions determine the fate of start-up firms?*

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Abstract

Using a survival analysis approach, this paper investigates the impact of initial financial conditions on the post-entry performance of firms. We examine whether initial financial conditions affect the duration of survival among start-up firms in Japan, distinguishing between failure and merger. We provide evidence that start-up firms that rely more on equity than debt financing are less likely to fail within a shorter period, but we find little evidence that initial equity size has a significant effect on the likelihood of failure. Moreover, we find the negative effect of equity financing on the likelihood of failure to be greater for start-up firms founded following the abolition of regulations governing a minimum paid-in capital requirement. Furthermore, the results reveal that start-up firms with larger initial equity are more likely to exit through merger. Overall, the findings suggest that initial capital structure is a critical determinant of exit route.

JEL Classification: C24; G32; M13

Keywords: Business failure; Competing risk; Equity financing; Initial financial conditions; Merger

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1. Introduction

Most, but not all, entrepreneurs recognize that financing is one of their greatest obstacles when starting their businesses. In fact, entrepreneurs often face difficulties in raising sufficient funds from capital markets. Because of the limited access to capital markets, some entrepreneurs are obliged to start their businesses with insufficient capital, and these businesses are then more susceptible to high rates of failure within a short period. In this respect, it has proven effective in improving initial financial conditions for firm survival. For this reason, some policy makers and scholars often emphasize the need for public support to improve initial financial conditions, which may result in promoting successful new businesses. However, little attention has been paid to how initial financial conditions affect the post-entry performance of firms, and their impact on firm survival and exit is far from being well understood.

Using a survival analysis approach, this paper investigates the impact of initial financial conditions on the post-entry performance of firms. We examine whether initial financial conditions affect the duration of survival among start-up firms in Japan, distinguishing between failure and merger. We provide evidence that start-up firms that rely more on equity than debt financing are less likely to fail within a shorter period, but find little evidence that initial equity size has a significant effect on the likelihood of failure. Moreover, we find the negative effect of equity financing on the likelihood of failure to be greater for start-up firms founded following the abolition of regulations governing a minimum paid-in capital requirement. Furthermore, the results reveal that start-up firms with larger initial equity are more likely to exit through merger. Overall, the findings suggest that initial capital structure is a critical determinant of exit route and this implies that initial financial conditions determine the fate of start-up firms.

The remainder of the paper is organized as follows. Section 2 discusses the research background, including a literature review and hypotheses development. Section 3 explains the data and method used in the paper. Section 4 presents the estimation results. Finally, we provide some concluding remarks.

2. Research background and hypotheses development

2.1. Financing of start-up firms

As Berger and Udell (1998) stated, small businesses are thought of as having a financial growth cycle in which financial needs and options change as the business grows, gains further experience, and becomes less informationally opaque. In practice, most start-up firms rely on internal sources of start-up finance, which primarily comprise the personal wealth of the founders (entrepreneurs) and that of family and friends (e.g., Storey and Greene, 2010). Moreover, initial equity financing usually tends to be restricted, with only internal suppliers of capital. Therefore, start-up firms with a greater demand must rely on external suppliers of capital, such as banks. In particular, bank loans for start-up firms are common in many countries, including Japan, where private equity investment by venture capital and angel investors is not yet fully developed.

If capital markets are perfect, firms with growth potential should be able to raise sufficient funds. However, in reality, capital markets are far from perfect, such that even if an entrepreneur has a good ability to expand the business, the entrepreneur cannot necessarily obtain sufficient funds. This situation arises because of information asymmetries between entrepreneurs and external suppliers of capital, such as banks. As a result, the costs of external suppliers of capital become higher because transaction costs arise more commonly for external suppliers of capital. In addition, information asymmetries invite adverse selection and moral hazard problems in capital markets, which generate agency costs, in addition to monitoring costs. Accordingly, although firms may prefer to rely on internal rather than external suppliers of capital to reduce the cost of financing, at least some are obliged to use other financial sources once they exhaust funds from internal suppliers of capital.

For the most part, start-up firms, which are the focus of this paper, have a shorter operating history, and lack a financial track record, when compared with incumbent firms. For these firms, agency costs tend to be higher because information asymmetries are more sever between entrepreneurs and external suppliers of capital.

Therefore, external suppliers of capital, such as banks, require higher risk premiums to start-up firms, which results in a significant increase in the cost of financing. As a result, some start-up firms with insufficient capital must use external financing at a higher cost.

When raising funds from external suppliers of capital, firms generally face the decision of issuing debt and/or equity. Generally, the combination of debt and equity firms use to finance is called capital structure. As Leary and Roberts (2005) argued, firms strive to maintain an optimal capital structure that balances the costs and benefits associated with varying degrees of financial leverage. Traditional arguments suggest that firms choose an optimal capital structure by trading off the benefits of financing, such as tax reductions, against the cost of financial distress.[1] This is because while debt financing creates a tax shield for the firm, it also increases the likelihood of bankruptcy, which induces the cost of financial distress. Accordingly, to remain solvent, firms would typically use equity rather than debt financing.

Not surprisingly, debt financing generates interest payments, which often place a financial burden on start-up firms beyond their expectations. This is because start-up firms need time to generate operating profits by getting their businesses on track. Although external suppliers of capital may be able to allow a moratorium on payment, they usually hesitate to extend repayment for start-up firms that do not have a long operating history. Therefore, start-up firms that rely more on debt financing are more likely to exit the market sooner. Unfortunately, there has been relatively little research into the capital structure of start-up firms. An investigation of the impact of initial financial conditions will provide a better understanding of how start-up firms raise their initial capital and survive in the market.

2.2. Post-entry performance and exit routes

The post-entry performance of firms has been addressed in a rich stream of literature.[2] As a benchmark argument, Gibrat's law states that firm growth is indepen-

[1] For more discussion on capital structure, see, for example, Titman and Wessels (1988) and Hovakimian et al. (2001).

[2] For more discussion on the post-entry performance of firms, see, for example, Parker (2009) and Storey and Greene (2010).

dent of size. While a large number of studies have tested Gibrat's law by empirically investigating the relationship between firm growth and size, some studies have estimated the determinants of firm survival in addition to firm growth (e.g., Evans, 1987). For the most part, these estimations can avoid selection bias because firm exit relates to lower growth rates. Besides, as survival is a precondition for firm growth, firms that survive in the market may attract entrepreneurs and initial investors.

The existing literature has explored how some factors affect firm survival in the market. To summarize these factors, Storey and Greene (2010) proposed five approaches: gambler's ruin, population ecology, resource-based theory (view), utility, and entrepreneurial learning.[3] In the resource-based view, the availability of resources and capabilities, rather than the environment, is a central focus of the post-entry performance of firms. In this respect, a deficiency of both financial and human resources decreases the likelihood of firm survival.

There are many arguments concerning the post-entry performance of firms. Indeed, the literature has well examined the impact of initial conditions—especially, initial size—on firm survival. Some studies have found the positive effect of initial size on firm survival (e.g., Audretsch and Mahmood, 1995). For instance, Agarwal and Audretsch (2001) provided evidence that small firms are confronted with a lower likelihood of survival than their larger counterparts using data on US firms. In contrast, Disney et al. (2003) showed the positive impact of initial size on the exit hazard for single establishments using data on UK firms (establishments), but the negative impact of current size on the exit hazard. Additionally, Coad et al. (2013) identified the significant negative impact of initial size on survival when controlling for lagged size. At the same time, some studies have addressed the impact of initial conditions on firm survival over time. For instance, Geroski et al. (2010) concluded that the impact of initial conditions on survival does not diminish rapidly over the first 5–10 years of a new firm's life, using data on Portuguese firms. Together, these findings suggest that whereas the impact of initial conditions may gradually disap-

[3]Based on findings from new bank start-ups in the US, Bamford et al. (2000) addressed the issues on new venture performance from three perspectives—external control, strategic choice, and resource—and emphasized that initial founding conditions and decisions are important.

pear over time, initial conditions continue to play a critical role in the post-entry performance of firms.

While many studies have focused on initial size, a few have paid attention to the impact of initial financial conditions on firm survival. In seminal work, Cooper et al. (1994) found that the level of capitalization, as measured by the total amount of capital invested at the time of first sale, contributes to marginal survival and growth using data on US firms (entrepreneurs). Then, Huyghebaert and Van de Gucht (2004) argued that the interaction between the nature of industry competition and a firm's initial debt ratio is highly important for explaining exit. Using data on Belgian firms, Huyghebaert and Van de Gucht found that entrepreneurial start-ups in highly competitive industries are more likely to exit and that leverage compounds this exit risk. Elsewhere, Huynh et al. (2010, 2012) investigated the impact of initial financial conditions—more precisely, the debt-to-asset ratio—on the duration of new entrants in the Canadian manufacturing industry, and identified a non-monotonic relationship between firm hazard and leverage (as measured by the debt-to-asset ratio). Additionally, Stucki (2014) found that firm survival and the achievement of profit break-even are negatively correlated with financial constraints using data on Swiss firms. Overall, these studies suggest that initial financial conditions, including leverage and financial constraints, matter for the post-entry performance of firms.[4]

Unlike the above studies, several studies on the survival of firms have considered different exit routes (e.g., Harhoff et al., 1998). Indeed, exit may include several forms other than business failure (bankruptcy), including voluntary liquidation and merger. In particular, we can regard exit through merger and acquisition (M&A) in part as a successful exit strategy, even though the firm ceases to exist in the market. Clearly, the impact of initial financial conditions may differ across these alternative exit routes. For instance, Grilli et al. (2010) found the different antecedents of the effects of firm size and age between closure and M&A using data on Italian

[4]Cassar (2004) examined the determinants of capital structure and types of financing for start-up firms and found that the larger the start-up firm, the greater the proportion of debt, long-term debt, outside financing, and bank financing. However, Cassar did not address the impact of initial financial conditions on the post-entry performance.

high-tech firms. As for the case of Japanese start-up firms, Kato and Honjo (2015) identified differences in the effect of entrepreneurs' human capital on survival and exit between exit routes comprising failure (bankruptcy) and nonfailure (voluntary liquidation and merger) outcomes. Overall, the findings of these studies suggest that the determinants of exit depend on the exit route itself. Ignoring these differences would place us in danger of misunderstanding the post-entry performance of firms. However, to our understanding, few empirical studies have examined the differences in the impact of initial conditions on the post-entry performance of firms across the variety of possible exit routes.

2.3. Hypotheses development

As already indicated, capital market imperfections enable start-up firms, including those with growth potential, to commence business with insufficient capital because of information asymmetries between entrepreneurs and external suppliers of capital. In this regard, small firms may be particularly susceptible to a cost disadvantage through diseconomies of scale. In addition, transaction and agency costs arising from information asymmetries are arguably more severe for small firms. Conversely, it is conceivable that firms with a sufficiently large initial size do not suffer from such cost disadvantages. Therefore, these firms are more likely to avoid failure in the market. Indeed, and as discussed, some studies have already found that initial size exerts a positive impact on firm survival (e.g., Audretsch and Mahmood, 1995; Agarwal and Audretsch, 2001).

In contrast, other studies have identified the negative effect of initial size on firm survival (e.g., Disney et al., 2003). For instance, Coad et al. (2013) suggested that a small start-up size enhances survival because of high growth since start-up. However, these results concerning initial size have generally used the size of employment or sales. It is therefore unclear how initial financial conditions affect the post-entry performance of firms.[5]

[5]In terms of the capital size of Japanese start-up firms, Honjo (2000) found the negative effect of paid-in capital on the likelihood of failure. However, the covariate for paid-in capital was current size, not initial size.

With respect to initial financial conditions, the debt ratio (leverage) is considered an important determinant of survival and exit. Outside the literature on start-up firms, Zingales (1998) found that highly leveraged firms are less likely to survive. As for start-up firms, Huynh et al. (2012) observed a positive relationship between initial leverage (the debt-to-asset ratio) and hazard rates, indicating that firms with higher levels of initial leverage are less likely to survive. To achieve sufficient capital size, start-up firms with less equity financing are compelled to rely on debt financing. As Robb and Robinson (2012) argued, start-up firms certainly tend to rely heavily on outside debt. However, if start-up firms achieve a sufficient capital size through debt financing, they may also have a higher probability of failure because of the additional financial burden of interest payments and credit constraints. For this reason, there is the possibility that the likelihood of failure increases with the initial debt size.

How start-up firms raise their initial capital plays a critical role in firm survival. To reduce the possibility of failure, start-up firms should use equity financing, rather than debt financing. In this respect, we consider that the initial leverage structure—conversely, initial equity ratio—has a significant impact on the survival of start-up firms and so we test the following hypothesis:

> **H1:** Start-up firms that rely more on equity than debt financing are less likely to fail within a shorter period.

Regarding initial equity financing, regulations governing a minimum paid-in capital requirement—more precisely, paid-in capital of no less than 10 million yen for a joint-stock company—was in place in Japan in and after April 1990, as a means of increasing initial equity financing, even for small and medium-sized enterprises. Consequently, because of the regulations, entrepreneurs could not found joint-stock companies without 10 million yen in capital. However, this requirement was removed when the new Companies Act was introduced in May 2006. The regulations, which were in effect from April 1991 through to April 2006, may have weakened the effect of the initial equity ratio on the post-entry performance of firms because it created an incentive for entrepreneurs to intentionally raise equity financing. In contrast,

the negative effect of the initial equity ratio may be greater following the abolition of the regulations. In this paper, we investigate the impact of the minimum paid-in capital requirement on the post-entry performance of firms and test the following hypothesis:

> **H2:** The negative effect of the initial capital ratio on the likelihood of failure is greater following the abolition of regulations governing a minimum paid-in capital requirement.

As discussed, we should also pay more attention to the possible exit routes when examining the factors affecting firm survival. More specifically, exit through merger differs substantially from failure, even though the firms in either case are both extinct. As already mentioned, the determinants depend on the exit route, such as failure and merger, and the impact of initial financial conditions may differ between the exit routes. Regarding the relationship between equity financing and merger, M&A is considered an extension of equity financing, as equity financing is typically associated with a loss of ownership. Therefore, start-up firms relying on equity financing are subject to takeover and merger. For comparison, we investigate the differences in the exit routes, dividing exits into failure and merger. We argue that while start-up firms that rely more on equity financing are less likely to fail within a shorter period, they are also more likely to be targeted as merger candidates. In this paper, we test the following hypothesis:

> **H3:** Start-up firms that rely more on equity than debt financing are more likely to exit through merger.

To test the above three main hypotheses, we present the data and model used in the empirical analysis in the following sections.

3. Data

3.1. Data source

The data used in this analysis come from a database compiled by Teikoku Databank, Ltd. (TDB), which is one of the major credit investigation companies in Japan

(comparable to Dun & Bradstreet in the US). This database is composed of financial statements as prepared using on Japanese Generally Accepted Accounting Principles (GAAP). We obtained data on unconsolidated financial statements in the initial accounting year when firms commenced business. Using this database, we constructed a data set to identify those factors affecting the survival and exit of start-up firms.

We define start-up firms as firms founded during the period from January 1995 to December 2010. To observe the event of exit, we set up an observation window in the period from January 1995 to January 2011; that is, we observed the duration of survival from one month (for firms founded in December 2010) to 192 months (for firms founded in January 1995). This observation period is set before the Great East Japan Earthquake in March 2011. Using the classification in TDB, we divided the exit routes into three types: failure, merger, and other.[6]

In Japan, there are several legal forms of business, including sole proprietorships, partnerships, and joint-stock companies. Of these, joint-stock companies are the most typical form of a limited liability company, while sole proprietorships and partnerships are generally considered to be privately held. Accordingly, we focus only on joint-stock companies, partly because most databases do not sufficiently provide accounting data for sole proprietorships and partnerships. At the same time, this enables us to examine how the regulations governing a minimum paid-in capital requirement, which applied to joint-stock companies, affects the duration of survival.

As a result, the data set of start-up firms contains joint-stock companies founded from January 1995 to December 2010. The data set covers firms in the industrial sectors of construction, manufacturing, information and communications (ICT), wholesale and retail trade, and business services. This contrasts with some earlier studies that focused on start-up firms only in the manufacturing sector (e.g., Huyghebaert et

[6]TDB provided information on the date of bankruptcy and we measured the duration of failure (bankruptcy) using the period from the date of foundation to the date of bankruptcy. It is important to note that bankrupt firms do not always exit the market and a few may actually survive through debt forgiveness. However, in practice, most bankrupt firms are liquidated and bankruptcy can be clearly regarded as an unsuccessful outcome. Therefore, in this analysis, failure (bankruptcy) is regarded as an exit route.

al., 2007). However, as Harhoff et al. (1998) emphasized, it is particularly important that the data set includes all major industries because of the growing importance of the service sector in industrialized countries. In practice, ICT and business services rather than manufacturing have attracted most new entrants in recent years. For this reason, we focus not only on manufacturing, but also on other industrial sectors.[7]

Several measurement issues arise when we construct our data set. First, because we were unable to obtain financial statements at the date of foundation, we instead used them in the first accounting year.[8] Second, the data set contains some subsidiaries and affiliated firms. As these firms may have very different capital structures from independent firms, we excluded from the data set those firms regarded as subsidiaries and affiliated firms by TDB. Additionally, we excluded only one firm from the data set because fixed assets were negative. Finally, the data set contains only a few firms of a large size. Although these firms may be de novo entrants, we considered firms with 100 employees or more in the first accounting year as outliers and likewise excluded them from the data set.[9]

As a result, the sample consists of 16,181 joint-stock companies founded during the period of 1995–2010 in Japanese industries.[10] Table 1 details the distribution of start-up firms in the sample, which also indicates the trend in the number of failures and mergers. As shown in Table 1, up until January 2011, 832 firms (5.1%)

[7]From the data set, we exclude firms in highly regulated industries and those in relatively unimportant sectors, including agriculture and forestry, fisheries, mining, finance and insurance, personal services, and public services.

[8]In this case, accounting months differ between firms, and therefore, the period of the first accounting year—more precisely, the number of months from the date of foundation to the first accounting date—is not equal in length across firms. To identify whether initial financial conditions depend on the period of the first accounting year, we regressed initial financial conditions, used as covariates in this paper, on this period. However, as we did not identify any significant relationship between this period and the initial financial conditions, we specified data in the first accounting year as representing the initial financial conditions.

[9]In the original data set, there are 120 start-up firms (0.7% of the sample) with 100 employees or more in the first accounting year.

[10]The percentages of start-up firms by industry are 52% (construction), 4% (manufacturing), 11% (ICT), 19% (wholesale and retail trade), and 14% (business services and others). As an aside, we note the relatively large number of construction firms in the final data set. This is because databases compiled by credit investigation companies (i.e., TDB) tend to target construction firms for credit investigation and construction firms tend to disclose their financial statements more readily to enable them to receive public works.

experienced failure (bankruptcy), while 437 firms (2.7%) exited the market through merger.[11]

3.2. Method

We apply a survival analysis approach when estimating the determinants of exit. However, as already mentioned, exit can entail multiple types. To take into account these different possible exit routes, we employ a competing risks regression.

Let T_{ij} denote the time to event j for firm i, and T_{ij} is observed at t when $T_{ij} \leq t$.[12] However, the time to event j is not always observed for all firms during the observation period. In other words, right censoring is common. Let C_i denote the censoring time, that is, the period to the end of the observation period for firm i. The censoring time, C_i, varies depending on the date of foundation of firm i and the end of the observation period, and T_{ij} is observed if $T_{ij} \leq C_i$. In addition, a competing event may occur prior to event j. Here, let $\tilde{T}_{ij}$ denote the time to the competing event for firm i. Because of the occurrence of the competing event, either T_{ij} or $\tilde{T}_{ij}$ can be observed for firm i. More precisely, we observe event j or the competing event when $\min\{T_{ij}, \tilde{T}_{ij}\} \leq C_i$.

Following Gray (1988) and Fine and Gray (1999), we formalize a subdistribution hazard for event j, $\gamma_{ij}(t)$, as follows:

$$\gamma_{ij}(t) = \lim_{\Delta t \to 0} \frac{\Pr\left(t < T_{ij} \leq t + \Delta t \mid C_i \wedge T_{ij} > t \cup \tilde{T}_{ij} \leq t\right)}{\Delta t}, \tag{1}$$

where $a \wedge b$ denotes $\min\{a, b\}$. To estimate the determinants of event j, we assume that its subdistribution hazard is written by

$$\gamma_j(t; x_i) = \gamma_{j0}(t) \exp\left(x_i' \beta\right), \tag{2}$$

where x_i is a vector of firm i's covariates affecting the event of interest, β is a vector of the estimated parameters, and $\gamma_{j0}(t)$ is the baseline subhazard.

[11] We classified 80 firms (0.5%) as "other," which indicates voluntary liquidation without bankruptcy or merger, and included them in the sample. However, unlike Kato and Honjo (2015), we did not examine the determinants of voluntary liquidation in this analysis.

[12] In this analysis, t is measured by firm age and $t = 0$ at the date of foundation. That is, the duration indicates how long firm i survives in the market after the date of foundation.

There are two events of interest (failure and merger) in this analysis. Using the subdistribution hazards for failure and merger, we examine the factors affecting the likelihood of failure and merger for start-up firms.

3.3. Covariates

Following the hypotheses discussed in Section 2, we define covariates affecting the subdistribution hazard of failure and merger among start-up firms. To capture the initial capital size, we define a covariate ($\ln TF$) as the logarithm of total financing in the first accounting year. In this analysis, total financing is measured by the sum of debt and equity financing. Additionally, a covariate for initial equity size ($\ln E$), which does not include debt financing, is defined as the logarithm of equity financing.[13]

To test H1 and H3, we use a covariate for the initial equity ratio (E/TF), defined as the ratio of equity financing to total financing in the first accounting year. However, given that reported equity in financial statements includes retained earnings, it is likely that equity overestimates the effect of initial capital size on failure. Therefore, following Huyghebaert and Van de Gucht (2004), we do not include retained earnings in equity financing. Additionally, liabilities include various accounting items, such as accrued expenses and allowances, which differ considerably from debt financing as raised from capital markets. Accordingly, we restrict debt financing to short- and long-term loans, commercial paper, and corporate bonds, not total liabilities (debt).[14]

As discussed, regulations governing a minimum paid-in capital requirement were in place in Japan between April 1990 and April 2006. To identify the impact of the regulations on firm survival, we specify an interaction term between equity financing and the regulation period, as measured by a dummy variable representing the period after the enforcement of the new Companies Act ($NOREQ$), in the regression

[13]It would be interesting to highlight the composition of equity financing. However, we were unable to classify equity financing into different types of ownership, such as individual investors and venture capital, using the available data.

[14]Likewise, we do not include trade credit in debt financing because it is difficult to determine whether trade credit is debt financing as raised from capital markets.

model.

In addition to debt and equity financing, we employ a covariate for initial capital expenditures ($CAPEX$) to identify the effect of asset structure on firm survival, as measured by fixed assets, including intangible fixed assets. This is because, given that capital expenditures tend to generate illiquid assets, it is plausible that start-up firms with higher capital expenditures have a higher risk of failure in the market.

As is often argued, innovative firms are more likely to rely on external financing than less innovative firms because of more attractive investment opportunities (e.g., Aghion et al., 2004). However, as R&D projects have a higher risk, it is not easy for start-up firms to raise funding for R&D investment from external suppliers of capital. Further, as Carpenter and Petersen (2002) emphasized, physical investments designed to embody R&D results are likely to be firm specific and therefore have little collateral value. In addition, Czarnitzki and Hottenrott (2011) argued that start-up firms are more financially constrained because they cannot use earlier profit accumulations for financing their R&D projects. Honjo et al. (2014) therefore concluded that these features of R&D prevent start-up firms from accessing capital markets. Because of the high risk of R&D projects and their less valuable assets, we hypothesize that innovative start-up firms are more likely to fail within a shorter period. We specify a dummy variable (RD) to identify R&D-oriented start-ups.

It is also possible that industry conditions, such as industry growth and demand, affect the post-entry performance of firms. To control for the difference in industry conditions, we specify dummy variables for construction, manufacturing, ICT, wholesale and retail industries in the regression model.

Furthermore, the sample comprises start-up firms for which the year of entry differs across firms. Because start-up firms in the sample do not necessarily commence business at the same time, they may then face different macroeconomic conditions. To control for these differences in entry timing between firms, we include entry cohort dummies in the regression model. The cohort dummies represent the year of entry of the firms in the sample.[15]

[15]Essentially, we define the cohort dummies on a one-year period basis. However, we do not observe the failure of firms founded in 2010 and the merger of firms founded in 2009 and 2010 until

Table 2 lists the definitions of the covariates. We measure the covariates, lnTF, ln$E$, E/TF, $CAPEX$, and RD, based on the first accounting year after the date of the firm's foundation. Table 3 presents the descriptive statistics of the covariates used in the analysis and those of the debt and equity financing. Table 3 shows that the mean of debt financing (approximately 22 million yen) is larger than that of equity financing (approximately 14 million yen), while the mean of E/TF indicates that debt financing accounts for more than half of total financing upon start-up.

4. Estimation results

4.1. Failure

We estimate the determinants of failure and merger using the competing risks regression based on firm age. Table 4 presents the estimated coefficients of the covariates ($\hat{\beta}$) for failure. While we use the covariate for initial capital size (lnTF) and initial equity size (ln$E$) in columns (i) and (ii), respectively, we use the covariate for the initial equity ratio (E/TF) in column (iii). Additionally, the interaction terms of ln$E$ and $NOREQ$ and of E/TF and $NOREQ$ are included in columns (iv) and (v), respectively.

As shown in Table 4, the coefficients of lnTF are positive in column (i), indicating that start-up firms with a larger initial capital size are more likely to fail within a shorter period. The results are consistent with Coad et al. (2013) who found a significant negative effect on firm survival when controlling for lagged size. In addition, the coefficients of ln$E$ are insignificant in column (ii). As a result, we find little evidence that initial equity size has a significant effect on the likelihood of failure.[16] These results indicate that a small start-up size enhances survival and that start-up firms cannot decrease the likelihood of failure by increasing their initial capital size.

In contrast, the coefficients of E/TF are negative at the 1% significance level in column (iii). The results reveal that start-up firms that rely more on equity financ-

January 2011. Therefore, in this case, we use a combined dummy, being the cohort dummy for firms founded during the periods of 2009–2010 and 2008–2010, to obtain the estimates in the regression model.

[16]Even when we measure initial equity size using paid-in capital, we do not obtain a negative relationship between failure and initial equity size.

ing are less likely to fail within a shorter period and we provide evidence to support H1. In other words, start-up firms that rely more on debt financing are more likely to fail.[17] Although start-up firms tend to rely on debt financing when commencing business, as our findings suggest, the likelihood of failure increases with the ratio of debt financing. This is presumably because interest payments are more likely to become a financial burden during the start-up period. To reduce the probability of bankruptcy, start-up firms should secure equity financing rather than debt financing, which will result in more stable businesses.

While the interaction term between $\ln E$ and $NOREQ$ is insignificant in column (iv), that of E/TF and $NOREQ$ is negative at the 5% significance level in column (v). These results reveal that while initial equity size does not affect the likelihood of failure, the negative effect of the initial equity size and the equity ratio on the likelihood of failure increases in the absence of a minimum paid-in capital requirement. This provides evidence supportive of H2. The findings indicate that the negative effect of the initial equity ratio on the likelihood of failure is greater following the abolition of this requirement. Conversely, we can say that the initial equity ratio did not exert a more significant effect on firm survival when regulations governing a minimum paid-in capital requirement were in place. This may be because start-up firms intentionally raised equity financing to achieve the minimum paid-in capital requirement.[18] These findings imply that start-up firms can raise equity financing more effectively without regulations governing a minimum paid-in capital requirement.

The coefficients of $CAPEX$ are positive at least at the 5% significance level in all of the columns in Table 4. Overall, we find that start-up firms with higher capital expenditures are more likely to fail within a shorter period. The results indicate

[17] Musso and Schiavo (2008) found that financial constraints, as measured by a synthetic index, significantly increase the probability of exiting the market. We also measured financial constraints using several other covariates, including the ratio of cash flow to total assets, and identified a negative relationship between failure and cash flow.

[18] In practice, firms with paid-in capital of 10 million yen account for about 71% of the sample firms founded from January 1995 to April 2006, but only for about 7% of the sample firms founded from May 2006 to December 2010. This implies that most firms raised equity financing simply to achieve the minimum paid-in capital requirement.

that as capital expenditures increase at start-up, firms lose liquidity. Therefore, start-up firms that invest heavily in fixed assets may face difficulties in surviving. Furthermore, the coefficients of RD are positive, but not sufficiently significant. We thus do not identify the effect of R&D investment on the likelihood of failure.[19]

4.2. Merger

Table 5 presents the estimated coefficients of the covariates for merger, corresponding to those for failure shown in Table 4.

As shown in Table 5, the coefficients of $\ln TF$ are positive at the 1% significance level in column (i). The coefficients of $\ln E$ are also positive at the 1% significance level in column (ii). Accordingly, we find that initial equity size has a positive effect on exit through merger, which differs from the findings in Table 4. The results indicate that start-up firms with larger initial capital are more likely to exit the market through merger.

The coefficients of E/TF are positive at the 1% significance level in column (iii). The results reveal that start-up firms that rely more on equity financing are more likely to exit through merger within a shorter period and we provide evidence to support H3. While the initial equity ratio has a negative effect on failure in Table 4, it has a positive effect on merger in Table 5. We thus obtain evidence that the determinants of exit depend on the exit route itself and that the initial equity ratio decreases the likelihood of failure, but increases the likelihood of merger. These findings suggest that start-up firms with a higher ratio of equity financing are more likely to be targeted for merger. We also conjecture that firms that can establish their capital structures using equity financing at start-up may have more opportunities to seek a strategic exit through merger. In this respect, the findings imply that initial capital structure determines the future exit route. More specifically, start-up firms relying more on equity financing are more likely to rely on equity markets. In this respect, path dependence in financing structure is a significant feature in

[19] As an alternative, we could use R&D intensity, as measured by the ratio of R&D expenditures to sales. In practice, we did not obtain significant results when using the covariate for R&D intensity. This is partly because most start-up firms do not sufficiently have R&D expenditures when commencing business.

determining the post-entry performance of firms.

Meanwhile, the interaction term between ln$E$ and $NOREQ$ and that between E/TF and $NOREQ$ are insignificant in columns (iv) and (v). We thus provide little evidence that the effects of the initial equity size and the equity ratio depend on the presence or absence of a minimum paid-in capital requirement. The results indicate that start-up firms that rely more on equity financing are more likely to be targeted for merger, irrespective of such regulations.

The coefficients of $CAPEX$ are negative at the 1% significance level in columns (i), (ii), and (iv). The results indicate that start-up firms with higher capital expenditures are less likely to exit through merger. Accordingly, these findings suggest that start-up firms that invest heavily in fixed assets have fewer opportunities to merge. Finally, the coefficients of RD are negative but insignificant, suggesting no effect of R&D investment on exit through merger.[20]

5. Conclusions

Using a survival analysis approach, this paper investigated the impact of initial financial conditions on the post-entry performance of firms. We examined whether initial financial conditions affect the duration of survival among start-up firms in Japan, distinguishing between failure and merger. We provided evidence that start-up firms that rely more on equity than debt financing are less likely to fail within a shorter period, but we found little evidence that initial equity size has a significant effect on the likelihood of failure. Moreover, we found the negative effect of equity financing on the likelihood of failure to be greater for start-up firms founded following the abolition of regulations governing a minimum paid-in capital requirement.

[20] Agarwal and Audretsch (2001) found that the patterns of the hazard rates differ substantially across the different environments defined by life cycle stage. In particular, mergers may occur in industries with growth potential because acquiring firms have an incentive to expand their business in that industry. To capture the differences in growth and demand in the life cycle stages across industries, we also used a proxy for industry growth potential, as measured by the median industry's market-to-book (MTB) ratio in the industry based on the two-digit Standard Industrial Classification. A a result, we found that industry MTB exerts a significantly positive effect on the likelihood of merger, while we did not find any significant effect on the likelihood of failure. This suggests that start-up firms are more likely to exit through merger in industries with a higher demand for investment, such that established firms seek suitable targets for M&A.

Furthermore, the results revealed that start-up firms with larger initial equity are more likely to exit through merger. Overall, the findings suggest that initial capital structure is a critical determinant of exit route.

Of course, there are several limitations in this analysis. To start, we did not discuss which sources firms select to obtain their capital at start-up. In other words, we paid little attention to corporate governance because of the lack of information about the ownership structure of start-up firms. In addition, we focused only on initial financial conditions taken from financial statements in the first accounting year and we would need longitudinal data tracing changes in capital structure to elaborate upon these findings. However, this may result in selection bias because firms are less likely to provide their financial statements immediately prior to exit. Nonetheless, further development of this analysis would certainly provide greater insights into post-entry performance, and into precisely how start-up firms raise funds for their survival.

Despite these limitations, we contribute to providing new insights into how initial financial conditions matter for the survival of start-up firms. To date, there has been much attention in the literature on the effect of firm size on survival and growth for testing Gibrat's law. Interestingly, we have provided evidence on the impact of initial capital structure, rather than initial capital size, on the post-entry performance of firms. Specifically, the initial equity ratio exerts a greater influence without regulations governing a minimum paid-in capital requirement. This implies that we could obtain more effective initial financing through easing unnecessary regulations on business start-ups. Furthermore, our findings indicate that the determinants of survival and exit differ according to exit route. In particular, we shed light on how the effects of initial financial conditions differ between failure and merger. This also implies that start-up firms establish their capital structures when commencing business, and that those firms that rely more on equity financing may have better opportunities for a strategic exit, such as in the form of merger.

Appendix

First, we present the estimated subhazard ratios ($\exp(x_i'\hat{\beta})$) for failure and merger in Tables A1 and A2, respectively. These tables correspond to the estimated coefficients for failure and merger shown in Tables 4 and 5.

Then, for robustness, we consider a few modifications in the estimation. We restrict the subsample to start-up firms with paid-in capital of no less than 10 million yen in the first accounting year without regard to the foundation date and estimate the regression models. As shown in Table 1, the number of start-up firms in the sample increased from 2006. This is because, as already mentioned, the regulations governing a minimum paid-in capital requirement was abolished in May 2006 when the new Companies Act was introduced and firms with paid-in capital of less than 10 million yen could be founded as joint-stock companies. Therefore, there is the possibility that the smaller paid-in capital of start-up firms founded in and after May 2006 significantly affected the results in Tables 4 and 5.

Table A3 presents the estimation results for failure and merger when we restrict the subsample to start-up firms with paid-in capital of no less than 10 million yen without regard to the foundation date, following the regression models in columns (iii) and (v) of Tables 4 and 5. The results in Table A3 are almost consistent with those in Tables 4 and 5, and therefore our findings about initial financial conditions are robust regardless of smaller paid-in capital. We also find that the interaction term between initial financial conditions and regulations governing a minimum paid-in capital requirement has a significant effect at the 5% level in column (ii) of Table A3.

In addition, Table A4 presents the estimation results for failure and merger when we restrict the subsample to start-up firms in industries other than construction, following the regression models in columns (iii) and (v) of Tables 4 and 5. This is because, as already shown, start-up firms in the construction sector account for more than half of the firms in the sample and there is the possibility that the results in Tables 4 and 5 depend heavily on conditions in the construction sector. However,

the results in Table A4 are almost consistent with those in Tables 4 and 5, and therefore our findings are robust in the absence of firms in the construction sector from the sample. However, the coefficients of RD are, in part, significant concerning the likelihood of failure. As start-up firms in the construction sector are less likely to invest in R&D, we do not find any significant relationships in Tables 4 and 5.

Finally, Table A5 presents the estimation results including the time-variant coefficients, following the regression models in columns (iii) and (v) of Tables 4 and 5. We identify the significant effects of initial financial conditions, as measured by the initial equity size and the equity ratio for failure and merger, respectively. As Geroski et al. (2010) found, it is likely that the effect of initial conditions decreases as time goes by. Accordingly, we examine how the effects of initial conditions diminish over time using time-variant covariates, with interaction terms between E/TF and t included in columns (i) and (iii), and E/TF and $\log t$ are included in columns (ii) and (iv) of Table A5. In terms of failure, as shown in Table A5, the time-variant coefficients of E/TF are positive at the 5% significance level. Thus, while the initial equity ratio has a negative effect on the likelihood of failure, we find that its effect decreases over time, which is consistent with the findings of Geroski et al. Additionally, in terms of merger, the time-variant coefficients of E/TF are positive, although the coefficients of E/TF are insignificant. We do not provide sufficient evidence that the effects of initial financial conditions on exit through merger diminish over time.

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Table 1. Distribution of start-up firms in the sample

Year	Entry	Exit			
		Failure	Merger	Other	Survival
1995	461	0	0	0	461
1996	560	1	0	0	920
1997	438	4	3	0	1,351
1998	465	12	4	0	1,800
1999	518	20	8	0	2,290
2000	568	28	11	0	2,819
2001	480	50	21	0	3,228
2002	480	41	37	0	3,630
2003	504	50	31	0	4,053
2004	505	60	46	4	4,448
2005	531	60	36	5	4,878
2006	1,889	60	47	5	6,655
2007	2,376	85	48	9	8,889
2008	2,456	116	61	14	11,154
2009	2,261	123	49	15	13,228
2010	1,689	110	35	25	14,747
Jan. 2011	—	12	0	3	14,732
Total	16,181	832	437	80	

Note: The number of observations is 16,181.

Table 2. Definitions of covariates

Covariate	Symbol	Definition
Debt finance	D	Sum of short- and long-term loans payable to inside and outside creditors, commercial paper, and corporate bonds.
Equity finance	E	Sum of paid-in capital, deposits for subscriptions to shares, capital surplus, treasury shares, deposits to subscriptions for treasury shares, share warrants, convertible bonds, and warrant bonds.
Total finance	TF	$(= D + E)$
Initial capital size	$\ln TF$	Logarithm of total finance in the first accounting year.
Initial equity size	$\ln E$	Logarithm of equity finance in the first accounting year.
Initial equity ratio	E/TF	E/TF in the first accounting year.
Capital expenditures	$CAPEX$	Ratio of fixed assets to total assets in the first accounting year.
R&D	RD	Dummy variable for the firm investing in R&D or paying a license fee in the first accounting year.
Abolition of regulations governing a minimum paid-in capital requirement	$NOREQ$	Dummy variable for the firm founded in and after May 2006.
Industry dummies	—	Dummy variables for construction, manufacturing, ICT, and wholesale and retail trade.
Entry cohort dummies	—	Dummy variables for the firm founded in the year.

Note: All dummy variables take values of one if the stated condition holds, and zero otherwise. The reference category for the industry dummies is service and other industries. The reference category for the entry cohort dummies is 1995.

Table 3. Descriptive statistics

Covariate	Mean	SD	25%	Median	75%
D	$22,140$	$153,896$	0	$4,690$	$13,746$
E	$14,174$	$137,537$	$3,000$	$6,000$	$10,000$
$\ln TF$	9.499	1.177	8.865	9.393	10.111
$\ln E$	8.626	1.212	8.006	8.700	9.210
E/TF	0.569	0.341	0.260	0.529	1.000
$CAPEX$	0.174	0.200	0.026	0.100	0.249
RD	0.076	—	—	—	—
$NOREQ$	0.650	—	—	—	—

Note: SD indicates the standard deviation. The number of observations is 16,181.

Table 4. Estimation results for failure

	Failure				
	(i)	(ii)	(iii)	(iv)	(v)
Covariate	Coef.	Coef.	Coef.	Coef.	Coef.
$\ln TF$	0.121^{***}				
	(0.032)				
$\ln E$		0.021		0.031	
		(0.045)		(0.043)	
E/TF			-0.530^{***}		-0.424^{***}
			(0.113)		(0.118)
$\ln E \times NOREQ$				-0.103^{**}	
				(0.052)	
$E/TF \times NOREQ$					-1.478^{***}
					(0.468)
$CAPEX$	0.406^{**}	0.581^{***}	0.374^{**}	0.580^{***}	0.380^{**}
	(0.178)	(0.168)	(0.179)	(0.168)	(0.179)
RD	0.152	0.172	0.161	0.170	0.162
	(0.113)	(0.112)	(0.113)	(0.112)	(0.113)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	16,181	16,181	16,181	16,181	16,181
Number of events	832	832	832	832	832
Number of competing events	517	517	517	517	517
Log pseudolikelihood	$-7,028$	$-7,034$	$-7,023$	$-7,032$	$-7,017$
Wald χ^2	91.2^{***}	67.4^{***}	96.9^{***}	70.4^{***}	88.9^{***}

Note: Figures in parentheses are standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table 5. Estimation results for merger

	Merger				
	(i)	(ii)	(iii)	(iv)	(v)
Covariate	Coef.	Coef.	Coef.	Coef.	Coef.
$\ln TF$	0.582^{***}				
	(0.041)				
$\ln E$		0.706^{***}		0.706^{***}	
		(0.044)		(0.045)	
E/TF			0.518^{***}		0.532^{***}
			(0.182)		(0.188)
$\ln E \times NOREQ$				0.001	
				(0.062)	
$E/TF \times NOREQ$					-0.257
					(0.708)
$CAPEX$	-1.575^{***}	-1.188^{***}	-0.288	-1.188^{***}	-0.287
	(0.313)	(0.330)	(0.305)	(0.330)	(0.305)
RD	-0.302^{*}	-0.261	-0.132	-0.261	-0.132
	(0.175)	(0.176)	(0.174)	(0.176)	(0.174)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	16,181	16,181	16,181	16,181	16,181
Number of events	437	437	437	437	437
Number of competing events	912	912	912	912	912
Log pseudolikelihood	$-3,578$	$-3,548$	$-3,669$	$-3,548$	-3.669
Wald χ^2	406^{***}	466^{***}	167^{***}	470^{***}	169^{***}

Note: Figures in parentheses are standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A1. Estimation results for failure: subhazard ratios

	Failure				
	(i)	(ii)	(iii)	(iv)	(v)
Covariate	SHR	SHR	SHR	SHR	SHR
$\ln TF$	1.121^{**}				
	(0.035)				
$\ln E$		1.022		1.032	
		(0.046)		(0.044)	
E/TF			0.588^{***}		0.654^{***}
			(0.067)		(0.077)
$\ln E \times NOREQ$				0.902^{**}	
				(0.047)	
$E/TF \times NOREQ$					0.228^{***}
					(0.107)
$CAPEX$	1.427^{**}	1.787^{***}	1.453^{**}	1.786^{***}	1.461^{**}
	(0.247)	(0.300)	(0.261)	(0.300)	(0.262)
RD	1.160	1.188	1.175	1.186	1.176
	(0.130)	(0.134)	(0.132)	(0.133)	(0.132)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	16,181	16,181	16,181	16,181	16,181
Number of events	832	832	832	832	832
Number of competing events	517	517	517	517	517
Log pseudolikelihood	$-7,031$	$-7,034$	$-7,023$	$-7,032$	$-7,017$
Wald χ^2	87.0^{***}	67.4^{***}	96.9^{***}	70.4^{***}	89.0^{***}

Note: Figures in parentheses are standard errors. SHR indicates the estimated subhazard ratio. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A2. Estimation results for merger: subhazard ratios

	Merger				
	(i)	(ii)	(iii)	(iv)	(v)
Covariate	SHR	SHR	SHR	SHR	SHR
$\ln TF$	1.842^{***}				
	(0.075)				
$\ln E$		2.026^{***}		2.026^{***}	
		(0.089)		(0.091)	
E/TF			1.679^{***}		1.703^{***}
			(0.306)		(0.319)
$\ln E \times NOREQ$				1.001	
				(0.062)	
$E/TF \times NOREQ$					0.773
					(0.547)
$CAPEX$	0.216^{***}	0.305^{***}	0.750	0.305^{***}	0.750
	(0.068)	(0.101)	(0.229)	(0.101)	(0.229)
RD	0.740	0.770	0.877	0.770	0.877
	(0.128)	(0.135)	(0.153)	(0.135)	(0.153)
Industry dummies	Yes	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes	Yes
Number of observations	16,181	16,181	16,181	16,181	16,181
Number of events	437	437	437	437	437
Number of competing events	912	912	912	912	912
Log pseudolikelihood	$-3,611$	$-3,548$	$-3,669$	$-3,548$	$-3,669$
Wald χ^2	310^{***}	466^{***}	167^{***}	470^{***}	169^{***}

Note: Figures in parentheses are standard errors. SHR indicates the estimated subhazard ratio. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A3. Estimation results for failure and merger: subsample of start-up firms with paid-in capital of no less than 10 million yen

	Failure		Merger	
	(i)	(ii)	(iii)	(iv)
Covariate	Coef.	Coef.	Coef.	Coef.
E/TF	-0.475^{***}	-0.450^{***}	0.483^{***}	0.494^{***}
	(0.117)	(0.118)	(0.187)	(0.187)
$E/TF \times NOREQ$		-1.350^{**}		-0.660
		(0.670)		(0.743)
$CAPEX$	0.359^{*}	0.361^{**}	0.360	-0.358
	(0.183)	(0.183)	(0.312)	(0.312)
RD	0.139	0.139	-0.145	-0.145
	(0.116)	(0.116)	(0.177)	(0.177)
Industry dummies	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes
Number of observations	6,772	6,772	6,772	6,772
Number of events	781	781	427	427
Number of competing events	507	507	861	861
Log pseudolikelihood	$-6,479$	$-6,477$	$-3,551$	$-3,551$
Wald χ^2	46.9^{***}	50.3^{***}	95.9^{***}	98.6^{***}

Note: Figures in parentheses are standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A4. Estimation results for failure and merger: subsample of start-up firms in the manufacturing, ICT, wholesale and retail trade, and service sectors

	Failure		Merger	
	(i)	(ii)	(iii)	(iv)
Covariate	Coef.	Coef.	Coef.	Coef.
E/TF	-0.429^{***}	-0.345^{**}	0.490^{**}	0.490^{**}
	(0.151)	(0.157)	(0.203)	(0.209)
$E/TF \times NOREQ$		-1.097^{**}		1.0×10^{-4}
		(0.524)		(0.733)
$CAPEX$	0.538^{**}	0.537^{**}	0.154	0.154
	(0.220)	(0.220)	(0.301)	(0.301)
RD	0.302^{**}	0.301^{**}	-0.322	-0.322
	(0.141)	(0.141)	(0.211)	(0.211)
Industry dummies	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes
Number of observations	7,709	7,709	7,709	7,709
Number of events	459	459	340	340
Number of competing events	394	394	513	513
Log pseudolikelihood	$-3,615$	$-3,613$	$-2,699$	$-2,699$
Wald χ^2	52.9^{***}	54.6^{***}	58.9^{***}	59.3^{***}

Note: Figures in parentheses are standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Table A5. Estimation results including time-variant covariates for failure and merger

	Failure		Merger	
	(i)	(ii)	(iii)	(iv)
Covariate	Coef.	Coef.	Coef.	Coef.
E/TF	-0.976^{***}	-2.652^{***}	-0.234	-1.523
	(0.238)	(0.835)	(0.402)	(1.318)
$E/TF \times t$	0.006^{**}		0.011^{**}	
	(0.003)		(0.005)	
$E/TF \times \ln t$		0.509^{**}		0.504
		(0.199)		(0.321)
$CAPEX$	0.373^{**}	0.373^{**}	-0.294	-0.292
	(0.179)	(0.179)	(0.305)	(0.305)
RD	0.161	0.161	-0.133	-0.132
	(0.113)	(0.113)	(0.174)	(0.174)
Industry dummies	Yes	Yes	Yes	Yes
Entry cohort dummies	Yes	Yes	Yes	Yes
Number of observations	16,181	16,181	16,181	16,181
Number of events	832	832	437	437
Number of competing events	517	517	912	912
Log pseudolikelihood	$-7,021$	$-7,020$	$-3,666$	$-3,668$
Wald χ^2	106^{***}	110^{***}	174^{***}	174^{***}

Note: Figures in parentheses are standard errors. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.