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Dependence on External Finance and SME Survival

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Abstract

Small and medium-sized enterprises (SMEs) in Europe are highly dependent on bank financing. In the Netherlands roughly 80 percent of the SMEs finances themselves (partially) using external sources, mostly bank credit. In the aftermath of the 2008 global financial crisis, the profitability of European banks declined sharply and bank capital eroded, which in turn affected lending to SMEs negatively. Next to supply effects, also a deteriorating financial position of the firm or decreasing demand for its products could explain SMEs reduced access to financing.

In the Netherlands, the number of firm bankruptcies peaked in the aftermath of the financial crisis. Between 2009 and 2014 about 40,000 corporate firms defaulted, which is a 50 percent increase compared to the period before the global financial crisis. The question that this study addresses is whether, in the aftermath of the financial crisis, default probabilities of firms that depend more on external finance were affected more negatively than default probabilities of less dependent firms. We use balance sheet data of Dutch SMEs and information from the firm register obtained from Statistics Netherlands to answer this question.

The hypothesis is that the firms that are the most dependent on external finance experience a stronger increase in ending rates than the group of firms that is the least dependent on external finance. In this study, however, we do not find evidence for this hypothesis. Only when we limit the sample to the group of medium-sized firms we find a 2.1 percent extra increase in the ending rate of the most dependent firms compared to the group of firms that is the least dependent on external finance.

These results should be interpreted with caution because of four reasons. First, they are based on firm endings of which the majority are voluntary endings instead of bankruptcies. Second, the data only include firms paying corporate income tax, which excludes self-employed individuals. Third, the data only include firms that already existed in 2003. Finally, our method does not identify the level of the effect of the financial crisis on ending rates, but only as a difference relative to the reference group.

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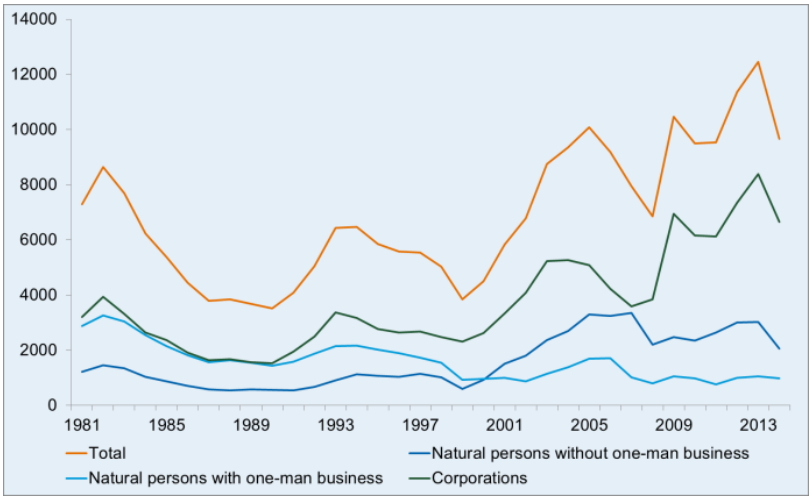
1 Introduction

Small and medium-sized enterprises (SMEs) in Europe are highly dependent on bank financing. In the Netherlands roughly 80 percent of the SMEs finances themselves (partially) using external sources, mostly bank credit. In the aftermath of the 2008 global financial crisis, the profitability of European banks declined sharply and bank capital eroded, which in turn affected lending to SMEs negatively. Next to supply effects, also a deteriorating financial position of the firm or decreasing demand for its products could explain SMEs reduced access to financing. In recent years many researchers have investigated the relative contribution of supply and demand effects to SME finance constraints. Van Beers et al. (2015a) show that in the Netherlands supply effects can explain approximately 12 percent of the decreased sales growth of SMEs. To alleviate SME's financing constraints policy makers in Europe as well as in the Netherlands have launched various policy initiatives (OECD, 2016).

In the Netherlands, the number of firm bankruptcies peaked in the aftermath of the financial crisis. Between 2009 and 2014 about 40,000 corporate firms defaulted, see Figure 1.1. This is a 50 percent increase compared to the period before the global financial crisis. A natural question that arises is whether, in the aftermath of the financial crisis, default probabilities of firms that depend more on external finance were affected more negatively than default probabilities of less dependent firms. Defaults can either be a consequence of a stronger decrease in turnover or a result of liquidity problems.

Figure 1.1 The number of defaults in the Netherlands increased after the outbreak of the global financial crisis.



This study addresses this question by applying a similar empirical approach and data as used by Van Beers et al. (2014). We investigate how the impact of the global financial crisis on firm survival rates varies over various levels of dependence on external finance. We update the administrative financial dataset of Dutch SMEs as used by Van Beers et al. (2014), such that the data covers the period 2000-2012. Individual firm dependence on external finance is

calculated as the average debt-to-assets ratio in the period before the crisis. Following the literature, we assume that the firm's dependence on external finance is a time invariant characteristic. The firms are distributed into four quartiles based on the extent to which their capital structure depends on external sources. The first quartile contains the companies with the lowest external finance dependency, while the fourth quartile contains the companies that depend most heavily on external financing.

From the firm-level micro data, bankruptcies cannot be distinguished from voluntary endings, since micro data on bankruptcies were not available to us in the pre-crisis period. However, from aggregated data from alternative sources we know that in the period 2007-2012 bankruptcies only account for roughly 7 percent of total number of firm endings.[1] As a proxy for defaulting firms we use firms that end after making a loss in the preceding year(s). We refer to these firms as ending in financial distress.

Before the crisis (2006-2007), we do not find a statistical significant difference in the ending rates of firms in the least and most dependent quartiles. However, these firms were about 0.8 %-points more likely to end than firms in the second quartile and about 1.3 %-points more likely to end than firms in the third quartile. During the crisis, the ending rates of firms in the second and third quartile decreased compared to the ending rate of the least dependent firms. Next, the ending rate of the most dependent firms did not change during the crisis compared to the ending rate of the least dependent firms. These results are not in line with the hypothesis that, as a result of the crisis, more dependent firms experience a stronger increase in ending rates than less dependent firms. However, when analysing endings of medium-sized firms separately, we do find a positive crisis interaction effect for the most dependent firms of 2.1 %-points.

When looking at distressed endings, however, we do find that before the crisis (2006-2007), firms that were most dependent on external finance were about 0.7 %-points more likely to end in financial distress than firms in the least dependent quartile. This difference became 0.3 %-points smaller during the crisis (2008-2012), indicating that the direction of the crisis interaction effect is again not in line with the hypothesis.

These results should be interpreted with caution because of four reasons. First, they are based on firm endings of which the majority are voluntary endings instead of bankruptcies. Second, the data only include firms paying corporate income tax, which excludes self-employed individuals. Third, the data only include firms that already existed in 2003. Finally, our method does not identify the level of the effect of the financial crisis on ending rates, but only as a difference relative to the reference group.

The remainder of this report is structured as follows. In the next section we discuss the economic literature on the relation between access to external finance and growth, on the financial crisis, and on SME bankruptcies. The data are discussed in Section 3 and the

[1] The number of firm endings and the number of bankruptcies can be found on Statline.

estimation method is discussed in Section 4. The results are shown in Section 5 and Section 6 provides some concluding remarks.

2 Related Literature

2.1 Finance-growth literature

In their seminal paper Rajan and Zingales (1998) study the relationship between finance and growth. They show that industries that depend heavily on external finance grow faster in countries with more developed financial markets. Rajan and Zingales (RZ) compute their indicator for dependence on external finance using an industry level proxy for the share of capital investments not financed with operating cash flows. The RZ-indicator is calculated using US and Canadian industry data and relies on three assumptions. The first assumption is that financial markets in the US are relatively frictionless. Second, it should be the case that technological differences between industries explain the dependence on external finance. Third, the technological differences between industries should be constant across countries.

The finance-growth literature builds on the RZ strategy to investigate whether industries that are more dependent on external finance grow faster in countries with highly developed financial markets. In order to answer this question most studies estimate an equation of the form:

$$\begin{aligned} GROWTH_{jk} = \beta_0 &+ \boldsymbol{\beta}_1(COUNTRY\ INDICATORS) + \boldsymbol{\beta}_2(INDUSTRY\ INDICATORS) \\ &+ \delta(SHARE\ INDUSTRY\ j\ IN\ COUNTRY\ k\ IN\ 1980) \\ &+ \gamma(DEPENDENCE\ ON\ EXTERNAL\ FINANCE\ INDUSTRY\ j \\ &\times FINANCIAL\ DEVELOPMENT\ COUNTRY\ k) + \varepsilon_{jk} \end{aligned}$$

where $GROWTH_{jk}$ is the annual real value added growth of industry j in country k, and $\boldsymbol{\beta}_1$ and $\boldsymbol{\beta}_2$ are coefficient vectors. The value added growth is explained by country indicators and industry indicators. The coefficient γ measures the effect of the interaction between financial development and dependence on external finance. In a causal interpretation of the estimated equation, a positive estimate of γ implies that an increase in the financial development of a country has a stronger impact on the growth of industries that are more dependent on external finance. Rajan and Zingales (1998) indeed find a positive estimate of γ and a majority of the later studies confirm this finding. An overview of this literature can be found in Van Beers et al. (2015b).

2.2 Finance-crisis literature

Since the beginning of the financial crisis economists recognized that a too large financial sector could be detrimental to economic growth. Firms that are heavily dependent on external (bank) finance could for instance come into trouble when banks become more reluctant in granting loans in periods of financial turmoil. Van Beers et al. (2015b) use an identification strategy comparable to the RZ method to investigate the impact of the financial crisis on the performance of Dutch SMEs that differ in their dependence on external finance. If banks become more reluctant in financing (small) firms as a consequence of the financial crisis, one would expect to observe larger growth drops for SMEs that are more dependent on external finance. This indeed follows from the analysis: sales growth of the group of firms that depend most heavily on external finance decreases by 2.4 percent more than the sales growth of the least dependent firms.

The estimation strategy of Van Beers et al. (2015b) differs in two important ways from the RZ method. First, Van Beers et al. (2015b) construct the sample at the firm-level instead of the industry level. In this way they control for more detailed individual firm characteristics. Second, the indicator for dependence on external finance is defined as the pre-crisis debt-to-assets ratio. Before the crisis the Dutch market for SME finance was relatively frictionless and differences in debt-to-assets ratios between firms were driven by technological differences. Firms are divided in four groups according to their debt-to-assets ratios (most dependent on external finance, more dependent on external finance, less dependent on external finance, and least dependent on external finance).

In contrast to Van Beers et al. (2015b), Bijlsma et al. (2015) use data from 69 industries and from 29 OECD countries and employ an approach that is similar to the traditional RZ methodology. Using an industry-level panel dataset covering the OECD countries, they show that industries that depend more on external finance, experienced a lower value added growth compared to industries that depend less on external finance. Moreover, this effect is shown to be stronger in countries with a more leveraged financial system.

Abildgren et al. (2012) study the impact of firm characteristics on credit supply by banks. They find that firms in a difficult financial position face more credit constraints. Next, the researchers find that during the financial crisis the bank capital positions do not explain the reduction in credit supply.

Finally, Chodorow-Reich (2014) studies the effect of bank lending frictions on employment outcomes. The author compares post-crises employment outcomes of firms having pre-crisis relationships with healthy lenders to those having pre-crisis relationships with unhealthy lenders, using Lehman Brothers' bankruptcy as an exogenous treatment. The results show that pre-crisis relationships with unhealthy lenders cause worsening in the employment outcomes, decreases the probability of receiving post-crisis loans and increases the interest rates of such loans.

2.3 SME bankruptcy

Several studies investigate the determinants of SME bankruptcies, or firm endings, and predict bankruptcy probabilities. Cressy (1992) was one of the first studies that investigate the determinants of bankruptcy for small firms. Using data on small firms in the UK, the author shows that profitability and liability variables, especially the profit-to-debt ratio, are important in predicting bankruptcy. As the profit-to-debt ratio increases, the bankruptcy probability decreases.

Pompe and Bilderbeek (2005) investigate the prediction of bankruptcy of small and medium-sized industrial firms. Using data from Belgian firms in the period 1986-1994, the authors find that investigating the bankruptcy behaviour of young firms is a harder task compared to that of old firms. The authors also find that the cash flow to total debt ratio predicts SME bankruptcies best.

Shimizu (2012) studies the effect of small banks that specialize in relationship loans to small firms on bankruptcy of small firms using Japanese data. The author finds that these small banks reduce the bankruptcy ratio of small firms and help the recovery rate from financial distress.

Gupta et al. (2015) investigate the factors determining bankruptcy of small and medium-sized firms in the UK. By distinguishing between micro, small or medium-sized firms, the authors show that the determinants differ for micro firms and other firms. Moreover, their empirical results show that working capital, and short trade creditors/total assets and trade debtors/total assets ratios seem to be significant in predicting bankruptcies throughout different specifications. Firms with lower working capital, and higher short trade creditors/total assets and trade debtors/total assets ratios have higher bankruptcy probabilities.

Gupta and Gregoriou (2015) extend the paper by Gupta et al. (2015) to US firms. As for UK firms, determinants of bankruptcy seem to depend on whether the SME is a micro, small or medium-sized firm. After several detailed estimations, the authors find that financial expenses are positively correlated with bankruptcies probabilities for all SMEs, while capital growth and cash-flows are negatively correlated. Moreover, earnings ratios and liabilities are positively correlated with bankruptcy probability, but only for the small and medium-sized firms and not for micro firms.

The study by Varum et al. (2012) is most in line with what we aim to do, since they also analyse how the impact of a specific variable on firm exit rate changes during the crisis. While we are interested in the effect of dependence on external finance, Varum et al. (2012) analyse the effect of firm size on firm exit rates during the financial crisis using Portuguese data. The authors find that firm exit rates follow a cyclical trend and the financial crisis has increased exit rates. Moreover, they show evidence that the moderating effect of firm size on firm exit rates becomes smaller during crises. Therefore, the authors conclude that even

though small firms generally have a higher risk of exiting, larger firms suffer a greater exit hazard during recessions in comparison to smaller firms.

Table 2.1 Overview of bankruptcy studies

Study	Dataset	Method	Main results
Cressy (1992)	636 small UK firms, period 1970-1980	Logit models	Profitability and liquidity indicators main predictors for bankruptcy
Pompe and Bilderbeek (2005)	1369 Belgian SMEs, period 1986-1994	Multiple discriminant analysis MDA	The cash flow to total debt ratio predicts SME bankruptcies best.
Shimizu (2012)	1.6 million Japanese SMEs, period 1999-2006	Hausman-Taylor estimator	Relationship banking reduces the bankruptcy ratio of small firms and helps the recovery rate from financial distress.
Gupta et al. (2015)	393,895 UK SMEs, period 2000-2009	Hazard rate models	Firms with lower working capital, and higher short trade creditors/total assets and trade debtors/total assets ratios have higher bankruptcy probabilities.
Gupta and Gregoriou (2015)	40,000 USA SMEs, period 1990-2014	Hazard rate models	Financial expenses are positively correlated with bankruptcies probabilities for all SMEs, while capital growth and cash-flows are negatively correlated. Moreover, earnings ratios and liabilities are positively correlated with bankruptcy probability, but only for the small and medium-sized firms and not for micro firms.
Varum et al. (2012)	87,000 Portuguese SMEs, period 1991-1993; 2001-2003	Hazard rate models	Even though small firms generally have a higher risk of exiting, larger firms suffer a greater exit hazard during recessions in comparison to smaller firms.
Clarke et al. (2012)	22,000 firms from Eastern and Central Europe and the former Soviet Union, Interviews with the firms are conducted in the years 2002, 2005, 2008, 2009	Probit models	Being financially constrained during crises has a larger positive effect on the bankruptcy probability for larger firms than for smaller ones. Moreover, firms with access to external credit are more likely to survive the crises.

Clarke et al. (2012) use firm information from several countries to study financial constraints of the firms and their survival probabilities in early days of the recent global recession in Eastern European and Central Asian countries. The authors find that financial constraints become more problematic for the larger firms compared to the smaller ones, and

access to external credit is an important predictor for firm survival through the financial crisis.[2] Table 2.1 gives an overview of the studies on SME bankruptcies.

3 Data

Our dataset resembles the firm level SME dataset used in Van Beers et al. (2014). The dataset includes both balance sheets and income statements of Dutch firms over the period 2000-2012. The sample is limited to non-financial firms that pay corporate income tax. We selected SMEs using the European definition of SMEs.[3] According to this definition, a firm classifies as an SME if it has fewer than 250 employees and total assets below 43 million euro. Within the set of SMEs we distinguished micro, small, and medium-sized enterprises. Micro firms have less than ten employees and total assets below two million euro. Medium-sized enterprises employ more than 50 employees and have total assets above 10 million euro.[4] The group of small firms includes all firms that cannot be classified as micro or medium-sized enterprise.

We further limit the sample by focusing on the eleven largest industries. The other industries do not have enough observations to draw any conclusions on.[5] Table 3.1 provides an overview of the industries and the abbreviations used in the remainder of this study.

Table 3.1 Industries

Industry Classification CBS	Abbreviation in text
Agriculture, forestry, and fishing	Agriculture
Manufacturing	Manufacturing
Construction	Construction
Sale and repair of motor vehicles, motorcycles, and trailers	Car sale/repair
Wholesale trade	Wholesale
Retail trade	Retail
Transportation and storage	Transport
Accommodation and food service activities	Accommodation/food
Information and communication	Infcom
Consultancy, research, and other specialized business services	Consultancy/research
Renting and leasing of tangible goods and other business support services	Renting tangible goods

Source: CBS, CPB.

[2] In another study, Holmes et al. (2010) find that initial plant size of micro SMEs is negatively associated with the probability to survive after the crisis. On the other hand, analyzing Polish data, Kolasa et al. (2010) find that larger firms seem to resist better to the global financial crisis, and analyzing Asian data, Tsoukas (2011) shows that larger firms are affected less by financial constraints.
[3] See website of the European Commission.
[4] See website of the European Commission.
[5] Despite the fact that the health care industry is one of the largest industries, we leave it out of this study because it not comparable to the other industries.

3.1 Dependence on external finance

We determine the dependence on external finance by calculating an indicator at the firm level. The underlying idea is that the dependence on external finance is a firm-specific characteristic. Furthermore, we assume that a firms' dependence on external finance is time invariant, i.e., firms that relied heavily on external finance in the period before the financial crisis, were also the most dependent on external finance after the crisis. Compared to the traditional RZ-approach, calculating the dependence on external finance at the firm level has the advantage of accounting for potentially large differences in the dependence on external finance within industries and size categories.

Van Beers et al. (2015b) use the average debt-to-assets ratio in the period before the crisis as the indicator for dependence on external finance. Given that Dutch SMEs rely heavily on bank finance, the debt-to-assets ratio is a good proxy for the dependence on external finance. Van Beers et al. (2015b) calculate the debt-to-assets ratio in the period before the crisis (2000-2007), because the finance market was relatively frictionless in that period. In a frictionless market, the observed debt-to-assets ratio is a good indicator for the finance needs of firms. The firms are then divided into four groups according to the average debt-to-assets ratio and the sales growth of the four groups before and after the crisis is compared.

For this study, we cannot determine the dependence on finance in the period 2000-2007, since it would require that a firm exists in all these years. As a consequence, the survival probability equals one by definition for all firms in the pre-crisis period. Without variation in survival rates between the four groups in the pre-crisis period, we cannot test the common trend assumption. Data on firm endings is available for the period 2006-2012, which means that we have a shorter pre-crisis period compared to Van Beers et al. (2015b). Therefore, we calculate the debt-to-assets ratio in the period 2003-2005. This means that we require that a firm exists in these three years and also that its financial data are available. It also means that all firms are at least three years old when they end in 2006. We did not extent the requirement to exist in the years before 2003 to prevent that all relatively young firms would drop out of the sample.

Similar to Van Beers et al. (2015b), we divide the firms in four quartiles. The first quartile contains the firms with the lowest debt-to-assets ratio and the fourth quartile contains the firms that are most dependent on external finance. This allows us to compare survival probabilities of the four groups of firms in the pre-crisis period (2006-2007) with probabilities of failure in the crisis period (2008-2012). We obtained the average debt-to-assets ratio in the period 2003-2005 for 68,187 firms. For these firms the average ratio was 0.52 with a standard deviation of 0.37. The firms were classified in four quartiles using the boundary values 0.20, 0.48 and 0.77.

3.2 Firm endings

The firm register of Statistics Netherlands (Algemeen Bedrijvenregister or ABR) allows us to identify the total number of firm endings per year during the period 2006-2012. Unfortunately, the data is not available for earlier years and we do not know whether a firm ends voluntarily or because of a bankruptcy. Statistics Netherlands reports that the total number of firm endings was about 127,000 in 2012, while the number of legal bankruptcies (excluding personal bankruptcies of natural persons without a business) was about 8,000 in the same year.[6] These numbers include bankruptcies and endings of firms without the status of a legal person, but those firms are not included in our data. For legal persons the share of bankruptcies in total endings is likely higher.

On the one hand these figures indicate that the number of firm endings overestimates the number of bankruptcies. Most firms end voluntarily, for instance because of the retirement of the owner. On the other hand, the number of bankruptcies might be an underestimation for the number of firm endings as a consequence of the financial crisis. It is very well possible that some firms decided to stop, as a consequence of the financial crisis, without ending up in a legal bankruptcy procedure. Since legal bankruptcy data is not available at the firm level, our main analysis is based on the firm endings data.

Additionally, we construct a proxy for involuntary firm endings, or bankruptcies, by using the firm's reported financial data in the last three years before the actual firm ending. We label a firm as 'distressed' if its last known reported profit was negative. As a robustness check we also considered a stricter indicator for distressed firms, which we label as 'heavily distressed', where we require the firm to report a loss in the last two years before the actual firm ending.[7] These constructed proxies, to indicate firm endings as a result of financial distress, are in line with the definitions used by Gupta and Gregoriou (2015).

Table 3.2 gives an overview of the total number of firms in our sample for which financial data were available in the period 2003-2005 and the number of firms that dropped out of the sample in each year due to ending or for other reasons (e.g. mergers).

Table 3.2 Number of firms in sample

Year	Total SMEs	Endings	Left sample
2006	68,187	2031	807
2007	65,349	2249	1525
2008	61,575	3602	1357
2009	56,616	2551	975
2010	53,090	2989	3203
2011	46,898	1934	840
2012	44,124	2112	
Total	395,839	17468	8707

[6] The number of firm endings and the number of bankruptcies can be found on Statline.
[7] Note that, using these definitions, distressed endings are a subset of total firm endings and heavily distressed endings are a subset of distressed endings.

At the start of 2006 our dataset contains about 68,000 firms as is shown in Table 3.2. Between 2006-2012 about 17,500 of these firms ended (25.6 percent), of which 7,300 (10.6 percent) were identified as distressed endings and about 4,200 (6.1 percent) were identified as heavily distressed endings. Note that we probably underestimate the number of (heavily) distressed firms, because we could not determine whether a firm ended in financial distress if no financial results were available in any of the three years before ending. In addition to ending, in the period 2006-2011 about 8,700 firms (12.8 percent) leave the sample for other reasons, for example because they merge with another firm.

Table 3.3 Share of (distressed) endings

Year	Total endings	Distressed endings	Heavily distressed endings
2006	3.0%	1.3%	0.9%
2007	3.4%	1.5%	1.0%
2008	5.8%	2.3%	1.3%
2009	4.5%	1.8%	0.9%
2010	5.6%	2.2%	1.1%
2011	4.1%	1.9%	1.0%
2012	4.8%	2.1%	1.3%

Table 3.3 gives an overview of the share of endings, distressed endings and heavily distressed endings, as a share of the existing firms at the start of each year. Since 2008 the ending rate in our sample increased, with peaks in 2008 and 2010.

3.3 Descriptive statistics

In Table 3.4 we show the distribution of firms in the sample by size class, age group and industry. Firms are classified in these groups according to their state in the year that we first observe them (2006). We use these classifications to include dummy variables in our regression analysis.

Table 3.4 Number of firms in sample by size class, age group and industry

	Firms	Share (percent)
Size class		
Micro	48,028	70.4
Small	17,281	25.3
Medium	2,878	4.2
Total	68,187	100
Age group		
< 1980	17,366	25.5
1980-1989	11,253	16.5
1990-1999	27,017	39.6
2000-2003	12,551	18.4
Total	68,187	100
Industry		
Agriculture	2,779	4.1
Manufacturing	7,146	10.5
Construction	7,081	10.4
Car sale/repair	2,909	4.3
Wholesale	12,984	19.0
Retail	6,183	9.1
Transport	3,245	4.8
Accommodation/food	2,140	3.1
Infcom	4,058	6.0
Consultancy/research	16,780	24.6
Renting tangible goods	2,882	4.2
Total	68,187	100

The majority of the firms (70 percent) are micro firms, whilst medium-sized firms represent a relatively small portion of the sample (4 percent). There are relatively many young firms in the sample, which is caused by our method to construct the sample and the strong dynamics in the population of SMEs. The industry with the most firms in our sample is consultancy/research (25 percent), followed by wholesale (19 percent), manufacturing (11 percent) and construction (10 percent). The industry shares in our sample are comparable to the overall shares of these industries in the Dutch economy (in terms of number of firms).

Figure 3.1 shows the share of firms that end by size class. Micro firms clearly have the highest ending rates, which likely reflect stronger dynamics in this category. In the period 2006-2012, the average ending rate was 5.3 percent for micro firms, 2.7 percent for small firms and 1.9 percent for medium-sized firms. For micro firms the ending rate peaks in 2008, which coincides with the beginning of the financial crisis. In 2010, a year after the outbreak of the European sovereign debt crisis, the ending rate of micro-firm endings peaks again. For all size groups, the ending rate was on average lower in the pre-crisis years 2006 and 2007 compared to the period 2008-2012.

Figure 3.1 Firm endings by size class

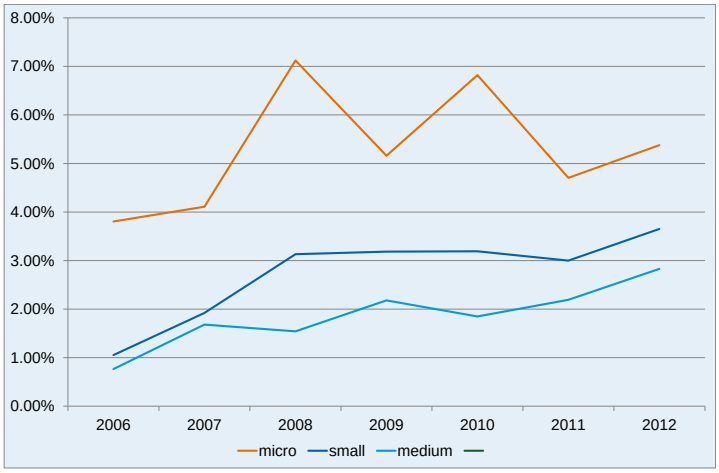


Table 3.5 shows the correlation between dependence on external finance and size class (panel a), age category (panel b), and industry (panel c). From Table 3.5 it follows that micro firms are on average less dependent on external finance than small and medium-sized firms. The correlation between dependence on finance and firm age is less clear: the youngest firms are relatively often in the most dependent category, while firms that started between 1980 and 1999 are relatively often in the least dependent category. Firms that started before 1980, in turn, seem to be a bit more dependent on external finance. Finally, the table shows that firms in the transport and accommodation/food industries are more often in the most dependent quartile, whereas consultancy/research firms are often not so dependent on external finance. For our identification it is important to notice that we have a sufficient number of firms in all cells of the distribution table. This enables us to disentangle the effects of firm size, age, industry, and dependence on external finance.

Table 3.5 Joint distribution of DEF and size class and DEF and age group

Panel a	DEF_least	DEF_less	DEF_more	DEF_most
Micro	29.5%	25.8%	22.2%	22.6%
Small	15.3%	23.5%	31.0%	30.2%
Medium	8.2%	21.6%	35.5%	34.6%
Panel b	DEF_least	DEF_less	DEF_more	DEF_most
< 1980	24.2%	25.9%	26.9%	23.0%
1980 – 1989	27.0%	26.4%	24.5%	22.1%
1990 – 1999	27.9%	24.7%	23.6%	23.8%
2000 – 2003	18.1%	23.2%	25.8%	32.9%
Panel c	DEF_least	DEF_less	DEF_more	DEF_most
Agriculture	26.1%	21.9%	24.1%	27.9%
Manufacturing	17.0%	25.3%	28.5%	29.2%
Construction	19.6%	27.2%	28.6%	24.6%
Car sale/repair	17.0%	21.8%	28.9%	32.3%
Wholesale	19.3%	23.7%	27.8%	29.2%
Retail	24.0%	25.3%	25.1%	25.7%
Transport	14.9%	21.2%	28.9%	34.9%
Accommodation/food	17.8%	23.6%	23.1%	35.5%
Infcom	28.6%	26.5%	23.3%	21.5%
Consultancy/research	40.0%	26.5%	18.5%	14.9%
Renting tangible goods	16.8%	24.6%	28.9%	29.7%

In Figure 3.2 we present the ending rates for four groups of SMEs based on their dependence on external finance. For all four groups the ending rate peaks in both 2008 and 2010. These peaks were also observed in Figure 3.1 for micro firms. Since micro firms represent over 70 percent of the firms in our sample, these firms drive the patterns of the overall sample. Since the effect of the crisis could be different for the three size classes, we also perform our regression analysis separately for different firm size classes.

Figure 3.2 Firm endings by dependence on external finance

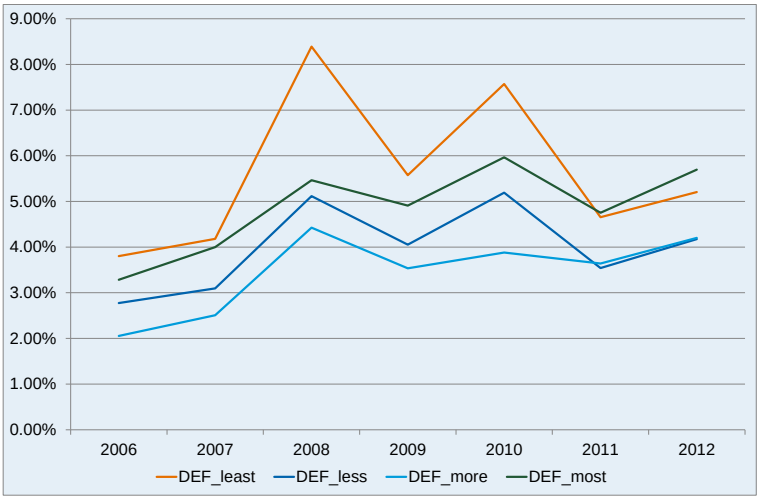
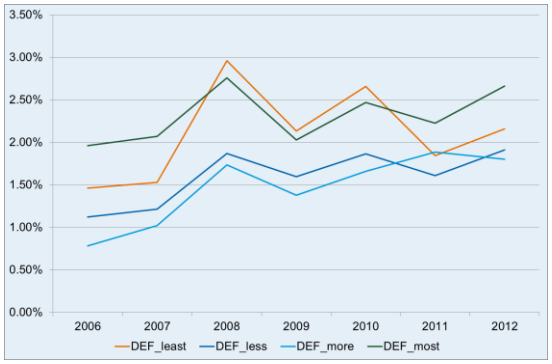


Figure 3.2 also shows that the least dependent firms have, on average, the highest ending rates, both before and after the financial crisis. The most dependent firms have the second-highest ending rates, followed by the second and the third quartile. This ranking changes in 2011 and 2012. Moreover, there is no clear indication that the ending rate of the more and most dependent firms increases more after the financial crisis compared to the increase for the less and least dependent firms.

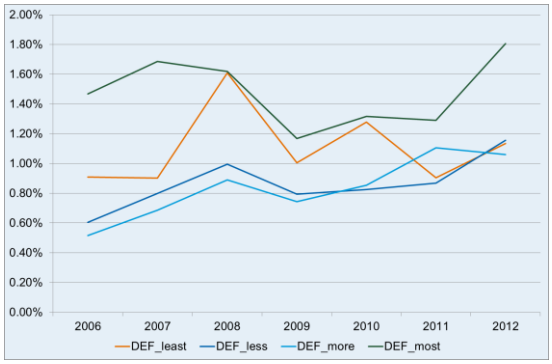
Figure 3.3 shows distressed ending rates (panel a) and heavily distressed ending rates (panel b), for the four groups of SMEs based on their dependence on external finance. Before the crisis, the firms with the highest dependence on external finance have the highest rate of (heavily) distressed endings. For distressed endings, most groups follow a similar pattern. For the heavily distressed endings the patterns appear less similar in the period before the crisis, especially for the firms that are the least dependent on external finance. Hence, this indicates a violation of the common-trend assumption.

Figure 3.3 Distressed firm endings by dependence on external finance

Distressed endings (a)



Heavily distressed endings (b)



Based on the descriptive statistics we conclude that ending rates of Dutch SMEs increased since the beginning of the crisis. It does not seem to be the case that the ending rates of the firms that depend more on external finance increased more steeply compared to those of firms that are less dependent on external finance. A formal econometric analysis is needed in order to be able to confirm this observation.

4 Methodology

4.1 Difference-in-differences

Since we are interested in the probability of ending, we use a binary variable that indicates whether or not firm i ended in year t as the dependent variable (END_{it}). Firms differ in their dependence on external finance (DEF_i). The hypothesis is that firms that are more dependent on external finance experienced a stronger increase in the probability to discontinue their business after the financial crisis relative to firms that are less dependent on external finance. To test this hypothesis we estimate the following equation:

$$\begin{aligned} END_{it} = {} & \alpha_{jt} + \boldsymbol{\beta}_1 DEF_i + \boldsymbol{\beta}_2 (DEF_i \times CRISIS_t) \\ & + \boldsymbol{\beta}_3 SIZE_i + \boldsymbol{\beta}_4 (SIZE_i \times CRISIS_t) \\ & + \boldsymbol{\beta}_5 AGE_i + \boldsymbol{\beta}_6 (AGE_i \times CRISIS_t) + \varepsilon_{it} \end{aligned} \qquad (4.1)$$

In this equation the industry-year fixed effects α_{jt} capture all factors that are constant for industry j in year t. The variables DEF_i, $SIZE_i$ and AGE_i refer to multiple time-invariant dummy indicators that indicate whether a firm belongs to one of the four groups for dependence on external finance, one of the three size groups and one of the four age categories. As such, $\boldsymbol{\beta}_1$and $\boldsymbol{\beta}_2$ are vectors containing three coefficients, $\boldsymbol{\beta}_3$ and $\boldsymbol{\beta}_4$ are vectors containing two coefficients, and $\boldsymbol{\beta}_5$ and $\boldsymbol{\beta}_6$ are vectors containing three coefficients.

Note that the reference firm belongs to the youngest group of micro firms that is the least dependent on external finance. This group of firms forms the control group and all effects are

relative to the effect for the control group. If, for instance, the coefficient for "most dependent X crisis" is positive, we learn that since the beginning of the crisis the ending probability increased more for the most dependent firms than for the least dependent firms. We do not make any assumption about the effect of the crisis on the ending probability of the reference group. We do not report this effect either, since it is captured by the industry-year fixed effects. The implication is that we do not measure the overall effect of tighter credit constraints on ending probabilities. Instead, we only estimate the additional effect for the groups of firms that are more dependent on external finance than the reference group.

For all three classifications (dependence on external finance, size and age) we include the dummies themselves as well as an interaction with the crisis dummy. The interpretation of the former is the difference with the reference group in terms of the ending rate before the crisis. The interpretation of the latter is the difference with the reference group in terms of the change in the ending rate since the crisis. The crisis dummy equals 0 in the years 2006-2007 and 1 in the years 2008-2012. We are most interested in the coefficients in $\boldsymbol{\beta}_2$, referring to the hypothesis that it is highest for the group of firms that are most dependent on external finance. We estimate equation 4.1 using OLS and using probit.

5 Results

The OLS estimates of equation 4.1 are reported in the first column of Table 5.1.[8] The second and third column report similar estimates for distressed and heavily distressed firm endings.

The first column shows that firms that are least (the reference group) and most dependent on external finance do not statistically significantly differ in their ending rates before the crisis. Before the crisis, the ending rate of the second quartile of the dependence on finance distribution is 0.8 %-points lower, while the ending rate of the third quartile is 1.3 %-points lower compared to the group that is least dependent on external finance. The constant term in the regression is 5.6 percent and reflects the average ending rate of the reference firm in 2006. The reference firm belongs to the quartile that is the least dependent on external finance, the smallest size class, started in 2000-2003, in the consultancy/research industry. Compared to this group of firms, a difference of 0.8 and 1.3 %-points implies a relative difference of 14 and 23 percent respectively.

The effect of the crisis on ending rates for the reference group (least dependent) is not shown in this table since it is captured by the industry-year fixed effects. However, from the estimation results we can infer how the crisis affects the ending rates of the other three groups relative to the group that is least dependent. We find that ending rates of the second quartile decreased by 0.7 %-points since the beginning of the crisis, relative to the least dependent group. For the third quartile we find a slightly smaller effect of –0.4 %-points,

[8] We also estimated models without the interaction terms. The inclusion of interaction terms does not influence the sign and order of magnitude of the other coefficients. These estimations are not shown, but they are available upon request.

while we do not find a statistically significant effect for the most dependent firms. These findings contrast our hypothesis, since we expected to find an increase in ending rates since 2008 for firms that were more dependent on external finance compared to the group of firms that is the least dependent on external finance.

The first column also shows that before the crisis, small and medium-sized firms were, respectively, about 1.9 and 2.1 %-points less likely to end than micro firms. After the crisis, small and medium-sized firms were about 2.3 and 3.4 %-points less likely to end than micro firms. This result contrasts with the finding reported by Varum et al. (2012), who find that the moderating effect of firm size on firm exits becomes smaller during crises. A possible explanation for this is that Varum et al. (2012) study crises in a different time period than our study.

Finally, before the crisis firms that started between 1990 and 1999 were about 1.4 %-points less likely to end than the youngest firms that started in the period 2000-2003. Firms that started before 1990 were 1.7 %-points less likely to end compared to the youngest firms. However, after the crisis the ending probability was about the same for all age groups.

Table 5.1 OLS results for probability of ending

	Total endings		Distressed endings		Heavily distressed endings	
Less DEF	-0.0083***	(0.0014)	-0.0023***	(0.0009)	-0.0016**	(0.0007)
More DEF	-0.0129***	(0.0014)	-0.0041***	(0.0009)	-0.0020***	(0.0007)
Most DEF	-0.0004	(0.0015)	0.0066***	(0.0010)	0.0074***	(0.0009)
Less DEF x Crisis	-0.0068***	(0.0019)	-0.0022*	(0.0012)	-0.0007	(0.0009)
More DEF x Crisis	-0.0036**	(0.0019)	0.0000	(0.0012)	0.0003	(0.0009)
Most DEF x Crisis	-0.0019	(0.0020)	-0.0030**	(0.0014)	-0.0039***	(0.0011)
Size: small	-0.0190***	(0.0010)	-0.0097***	(0.0007)	-0.0063***	(0.0006)
Size: medium	-0.0211***	(0.0017)	-0.0107***	(0.0011)	-0.0067***	(0.0010)
Size: small x Crisis	-0.0041***	(0.0014)	-0.0009	(0.0009)	0.0010	(0.0007)
Size: medium x Crisis	-0.0125***	(0.0023)	-0.0037**	(0.0015)	0.0001	(0.0013)
Started 1990-1999	-0.0140***	(0.0016)	-0.0058***	(0.0011)	-0.0024***	(0.0009)
Started 1980-1989	-0.0170***	(0.0018)	-0.0079***	(0.0012)	-0.0043***	(0.0010)
Started < 1980	-0.0167***	(0.0018)	-0.0078***	(0.0012)	-0.0043***	(0.0010)
Started 1990-1999 x Crisis	0.0122***	(0.0021)	0.0057***	(0.0014)	0.0030***	(0.0011)
Started 1980-1989 x Crisis	0.0166***	(0.0024)	0.0088***	(0.0016)	0.0054***	(0.0012)
Started < 1980 x Crisis	0.0160***	(0.0023)	0.0084***	(0.0015)	0.0055***	(0.0012)
Constant	0.0559***	(0.0021)	0.0224***	(0.0014)	0.0119***	(0.0011)
Industry x Year	YES		YES		YES	
N	395,839		395,839		395,839	
R-squared	0.009		0.004		0.002	

Notes: cluster-robust standard errors are reported in parentheses. Statistical significance levels of are indicated by * (10%), ** (5%) and *** (1%). The reference firm belongs to the quartile least dependent on external finance, the smallest size class, started in 2000-2003, industry-year: consultancy/research in 2006.

In the estimations for distressed endings and heavily distressed endings shown in column 2 and 3 of Table 5.1, we obtain mostly similar patterns. The coefficients are generally lower than in the first specification, which can be explained by the fact that (heavily) distressed ending rates are lower than ending rates. For the reference group the average ending rate in 2006 was 5.6 percent for total endings, 2.2 percent for distressed endings and 1.2 percent for heavily distressed endings. An important difference compared to the specification in column 1 is that before the crisis the (heavily) distressed ending rate is about 0.7 %-points higher for

the most dependent firms compared to the (heavily) distressed ending rate of the least dependent firms. Compared to the average (heavily) distressed ending rates for the reference group, these differences are relatively large. For total endings (column 1) there was no difference between these two groups. However, after the crisis, this difference is reduced by 0.3 %-points for distressed endings and by 0.4 %-points for heavily distressed endings. This result, again, contradicts our hypothesis that the firms that are most dependent on external finance would experience an increase in the probability of a distressed ending after the crisis.

Table 5.2 shows the estimates of equation 4.1 using a probit model instead of OLS. The signs and statistical significance of the coefficients are generally the same for the OLS and probit results. One of the differences is that for regular endings, the probit model does not return a statistically significant crisis interaction effect for the second and third quartiles and for medium-sized firms, while the OLS model does.

Table 5.2 Probit results for probability of ending

	Total endings		Distressed endings		Heavily distressed endings	
Less DEF	-0.1146***	(0.0191)	-0.0747***	(0.0266)	-0.0796**	(0.0321)
More DEF	-0.1944***	(0.0205)	-0.1451***	(0.0287)	-0.1127***	(0.0338)
Most DEF	0.0027	(0.0193)	0.1658***	(0.0251)	0.2442***	(0.0288)
Less DEF x Crisis	-0.0234	(0.0224)	-0.0188	(0.0310)	-0.0031	(0.0380)
More DEF x Crisis	0.0362	(0.0238)	0.0616*	(0.0330)	0.0493	(0.0396)
Most DEF x Crisis	-0.0087	(0.0226)	-0.0896***	(0.0296)	-0.1326***	(0.0347)
Size: small	-0.3442***	(0.0202)	-0.3625***	(0.0280)	-0.3130***	(0.0313)
Size: medium	-0.4113***	(0.0480)	-0.4187***	(0.0664)	-0.3260***	(0.0700)
Size: small x Crisis	0.0914***	(0.0231)	0.1210***	(0.0319)	0.1165***	(0.0364)
Size: medium x Crisis	-0.0193	(0.0553)	0.0475	(0.0759)	0.0609	(0.0817)
Started 1990-1999	-0.1578***	(0.0177)	-0.1247***	(0.0235)	-0.0658**	(0.0274)
Started 1980-1989	-0.2066***	(0.0236)	-0.1931***	(0.0320)	-0.1509***	(0.0372)
Started < 1980	-0.2107***	(0.0231)	-0.1965***	(0.0312)	-0.1564***	(0.0362)
Started 1990-1999 x Crisis	0.1412***	(0.0212)	0.1235***	(0.0284)	0.0885***	(0.0341)
Started 1980-1989 x Crisis	0.2033***	(0.0277)	0.2109***	(0.0377)	0.1887***	(0.0449)
Started < 1980 x Crisis	0.2019***	(0.0272)	0.2073***	(0.0368)	0.1973***	(0.0437)
Constant	-1.5629***	(0.0233)	-2.0011***	(0.0319)	-2.2742***	(0.0388)
Industry x Year	YES		YES		YES	
N	395,839		395,839		395,839	
Pseudo R-squared	0.027		0.022		0.019	

Notes: cluster-robust standard errors are reported in parentheses. Statistical significance levels of are indicated by * (10%), ** (5%) and *** (1%). The reference firm belongs to the quartile least dependent on external finance, the smallest size class, started in 2000-2003, industry-year: consultancy/research in 2006.

Since micro firms represent over 70 percent of the firms in our sample, the estimation results in Table 5.1 could potentially be driven by these micro firms. To see whether the results differ for micro, small or medium-sized firms, we repeat the estimation for total endings by size class. Table 5.3 shows the estimation results using total firm endings as the dependent variable.

Table 5.3 OLS results for probability of ending, by size class

	Micro		Small		Medium-sized	
Less DEF	-0.0080***	(0.0017)	-0.0085***	(0.0022)	-0.0103	(0.0071)
More DEF	-0.0152***	(0.0018)	-0.0084***	(0.0021)	-0.0094	(0.0069)
Most DEF	-0.0004	(0.0020)	0.0014	(0.0024)	-0.0066	(0.0069)
Less DEF x Crisis	-0.0082***	(0.0023)	-0.0013	(0.0031)	0.0090	(0.0084)
More DEF x Crisis	-0.0037	(0.0024)	-0.0010	(0.0030)	0.0121	(0.0082)
Most DEF x Crisis	-0.0045*	(0.0026)	0.0043	(0.0033)	0.0207**	(0.0084)
Started 1990-1999	-0.0147***	(0.0018)	-0.0076**	(0.0036)	-0.0216*	(0.0121)
Started 1980-1989	-0.0170***	(0.0022)	-0.0121***	(0.0036)	-0.0289**	(0.0119)
Started < 1980	-0.0167***	(0.0022)	-0.0122***	(0.0035)	-0.0271**	(0.0118)
Started 1990-1999 x Crisis	0.0122***	(0.0023)	0.0075	(0.0048)	0.0199	(0.0150)
Started 1980-1989 x Crisis	0.0162***	(0.0029)	0.0121**	(0.0048)	0.0249*	(0.0149)
Started < 1980 x Crisis	0.0186***	(0.0029)	0.0099**	(0.0046)	0.0128	(0.0145)
Constant	0.0572***	(0.0023)	0.0257***	(0.0043)	0.0410***	(0.0149)
Industry x Year	YES		YES		YES	
N	274,342		104,202		17,295	
R-squared	0.006		0.006		0.009	

Notes: cluster-robust standard errors are reported in parentheses. Statistical significance levels of are indicated by * (10%), ** (5%) and *** (1%). The reference firm belongs to the quartile least dependent on external finance, started in 2000-2003, industry-year consultancy/research: in 2006.

The estimates for micro and small firms compare quite well with the estimations on the entire sample. Again we cannot confirm the hypothesis that the probability of ending increases the most since the beginning of the financial crisis for the group of firms that is the most dependent on external finance. However, for medium-sized firms we find a rather large, statistically significant at the 5 percent level, and positive crisis interaction effect for the most dependent firms. The coefficient of 0.0207 indicates that the ending rates of medium-sized firms that were most dependent on external finance increased by about 2.1 %-points since the start of the crisis compared to ending rates of medium-sized firms that were least dependent on external finance. This result is consistent with our initial hypothesis.
This size of the interaction effect is substantial when compared with the average ending rate of the reference group in 2006, which was 4.1 percent.

6 Concluding remarks

This paper estimates the effect of the recent financial crisis on the relationship between SME ending rates and the dependence on external finance. The study covers the period 2006-2012 and we use a difference-in-differences approach to estimate this relationship. We use the financial crisis as an exogenous “treatment”, to identify differences in ending rates of firms which differ according to their dependence on finance. The underlying idea is that firms that depend more on external finance suffer more from the “treatment”. The mechanism would be that the financial crisis leads to an unanticipated contraction of credit, which, in turn, is more problematic for firms that are more dependent on external finance. Previous studies have shown the adverse effect of this mechanism on (sales) growth of firms (see e.g. Bijlsma et al., 2015; Van Beers et al., 2015b). Descriptive statistics also indicate a possible financial crisis effect on firm endings: the ending rate of SMEs increases from 3.2

percent in the pre-crisis period (2006-2007) to 5.0 percent in the post-crisis period (2008-2012).

From the estimations we find no relationship between the dependence on external finance and ending rates. Using a difference-in-differences approach, we cannot confirm the hypothesis that ending rates increased more since the start of the crisis for the firms that are more dependent on external finance. For distressed endings we find a statistically significant negative effect for the group of firms that is the most dependent on external finance. This means that the probability of a distressed ending increased less during the crisis for the most dependent group than for the least dependent group.

Individual estimations for micro, small and medium-sized firms indicate that firms that were least dependent on external finance had the highest ending rate before the crisis (2006-2007). Relative to these firms, the firms that were most dependent on external finance experienced a 0.5 %-points smaller effect of the crisis for micro firms (significant at the 10 percent level) and a 2.1 %-points stronger effect of the crisis for medium-sized firms (significant at the 5 percent level). For small firms the crisis effect did not differ statistically significantly between the firms that were least and the most dependent on external finance. This finding suggests that for medium-sized firms, ending rates of the most dependent medium-sized firms increased more since the beginning of the crisis than ending rates of the least dependent medium-sized firms.

The results should be interpreted with caution because of four reasons. First, we did not obtain data on legal bankruptcies but only on the total number of firm endings. This number also includes voluntary endings which are the majority of firm endings. Although we observe a strong correlation between the number of legal bankruptcies and the total number of firm endings, it is certainly possible that the relation between dependence on finance and legal bankruptcies differs from the relation between dependence on external finance and firm endings. We try to take this into account by looking at firm endings of firms that reported a loss prior to ending.

Second, our data sample includes only corporate income tax paying firms. Hence, the results cannot automatically be extrapolated to self-employed entrepreneurs in the Netherlands. Self-employed entrepreneurs are typically smaller in terms of turnover and assets than the firms in our sample. In addition, self-employed entrepreneurs often employ private property as collateral. Hence, if a credit contraction coincides with a downward housing price shock, self-employed could be relatively strongly affected since a decrease in collateral value would aggravate the reduction in access to credit.

Third, our sample only contains firms that already existed in 2003 and survived at least until 2006, so start-ups are excluded from the sample. The determinants of ending likely differ between start-ups and older firms. Therefore the importance of dependence on external finance could also differ between start-ups and older firms, in which case our results should not be generalized to the whole population of firms.

Fourth, the difference-in-differences approach does not allow us to estimate the level of the effect of tighter credit constraints on the ending rate of firms. We use the least dependent firms as the reference group and estimate the differences of the effect of the crisis between groups. We would only measure the level effect if the reference group is not affected by tighter credit constraints during the crisis, which is a very strong assumption.

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