Does the financial crisis change the effect of financing on investment?  
Evidence from private SMEs

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Abstract
The paper examines the real effects of the financial crisis for private firms. Analyzing a novel dataset from the Netherlands and controlling for multiple key factors, we find that investments of small and medium-sized private enterprises reduced significantly during and after the financial crisis. We find that both internal and external financing sources had a significant positive relationship with investment during the pre-crisis and post-crisis periods. But, during the crisis period, internal finance became significantly less influential on investment compared to external finance. The findings of the study suggest that borrowing from banks played a more prominent role in determining the investments of SMEs during the financial crisis of 2008-2009.

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1. Introduction

The financial crisis of 2008, regarded as the most serious crisis since the Great Depression, has brought financing and investment decisions of small businesses into additional attention. This augmented attention is mainly driven by the concern that a financial crisis more adversely affects small- and medium-sized enterprises (SMEs) which are widely regarded as a significant source of entrepreneurship, innovation, employment and economic growth (Ayyagari et al., 2007; Kirchhoff et al., 2007; Lee et al., 2010). During the crisis, private SMEs face additional restrictions and higher costs in gaining access to finance relative to large and listed firms (de la Torre et al., 2010). These hindrances arise from the distinct characteristics of private firms, for example, difficulty in accessing the public capital market, less track record, more information asymmetry, high failure rate, fewer opportunities of owners-managers for wealth diversification, and relatively lower availability of collateral (Beck et al., 2008; Danielson and Scott, 2007; Lopez-Gracia and Mestre-Barbera, 2011; Michaelas et al., 1999).

In this paper, we examine how the onset of the financial crisis has affected the real investments of private firms. We make three new contributions to the literature. First, we analyze the impact of two leading financing sources of SMEs: bank debt and internal financing. Private SMEs have also less alternative financing sources compared to large and listed firms (Becchetti et al., 2010). With the start of the financial crisis in 2008, commercial banks have continuously been tightening the supply of bank debt, leading to further financial constraints for private firms. Worsening financial constraints can produce an adverse impact on their investments. However,

\[1\text{ Although other sources like trade credit, private equity, leasing, government grants, informal lending, can be present, these two sources are found to be the most important sources of financing for SMEs.}\]
prior studies did not examine this issue. SMEs are also compelled to use more of their internally generated funds for new investments. Internal source of financing can thus become the dominant determinant of new investment. The empirical evidence in this regard lacks too.

Second, we complement existing studies which mainly focus on listed firms (see Duchin et al., 2010; Almeida et al., 2011 and Nguyen et al., 2015 for the United States, and Bo et al., 2014 for China) and analyze survey data (Danielson and Scott, 2007; Gregory et al., 2005). For private firms, the empirical evidence is scarce. Vermoesen et al. (2013) and Akbar et al. (2013) analyze SMEs from Belgium and the United Kingdom. Prior studies also examine just one or two crisis years only (Duchin et al. 2010; Akbar et al. 2013 and Vermoesen et al. 2013), and do not relate investment to the different sources of financing. We analyze the financial statement data of private firms and cover a relatively long time period (2004–2012).

The third contribution of the study comes from our focus on private firms from the Netherlands. During the financial crisis, the Dutch economy experienced severe shocks; various economic indicators like the gross domestic product, government debt, import, and export showed a significant decline while the unemployment rate increased. The Netherlands suffered for long from the aftermath of the financial crisis, and SMEs that primarily depend on banks for external finance were hit harder than large businesses. The results of our study provide insights on the effect of financial crisis for a small open economy where private firms are the main driver of its economic growth.

2 According to the 2014 SBA Fact Sheet of the European Union, the proportion of Dutch SMEs with rejected or unacceptable loan request was almost 39 percent in 2013 compared to the EU average of 14 percent. The proportion of SMEs reporting deterioration in the willingness of banks to provide loans stood at 39 percent in 2013 compared with 25 percent in the EU. The cost of borrowing for small loans relative to large loans which was 6 percent in 2007 on the eve of the financial crisis, reached an all-time high of 44 percent in 2013, far above the EU average of 24 percent. The Fact Sheet also reports that Dutch SMEs find it much harder to secure bank financing, and if they do they are charged a much higher interest rates than their EU peers. Source: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/performance-review/files/countries-sheets/2010-2011/netherlands_en.pdf.
The remainder of the paper is organized as follows. The second section presents the theories and hypotheses. In the third section, we describe the research methodology, which is followed by a description of the data. The empirical results of the study are presented in the fifth section. The last section summarizes the findings and concludes the paper.

2. Theories and hypotheses

Several theories are used to explain the investment behavior of firms. The Q-theory asserts that firms undertake investments when valuable growth opportunities are present (Rousseau and Kim, 2008). According to the asymmetric theory of investment, imperfections in the financial markets lead firms to face different degrees of financing constraints and therefore undertake different levels of investments (Kasahara, 2008). Because a financial crisis is associated with lower growth opportunities and higher financial constraints, both theories predict a decline in investment during a financial crisis. Kahle and Stulz (2013) argue that bank supply shock, credit supply shock, as well as demand shock during the crisis create considerable uncertainty and force firms to reduce their capital investments. We expect all these effects to be more profound for private firms relative to public firms.

Studies examine numerous empirical effects of the financial crisis. Kim et al. (2002) and Rousseau and Kim (2008) focus on the Korean financial crisis and observe contractions in the credit market. The negative effect of credit supply contraction is also documented by Akiyoshi and Kobayashi (2010) for Japan. Chen and Hsu (2005) find that during the Asian financial crisis, SMEs experience more output decline than large firms. In the context of the recent financial crisis, Ogawa and Tanaka (2013) analyze the survey data of Japanese SMEs and identify different types of shocks.
(demand, supply and financial shocks) faced by the firms. As for the impact on investment, Duchin et al. (2010) and Kahle and Stulz (2013) observe that the credit crisis has negatively affected exchange-listed firms in the USA. Akbar et al. (2013) and Vermoesen et al. (2013) report similar findings for private firms in the UK and Belgium, respectively.

Overall, shocks arising from the financial crisis cause private firms to reduce their investments. Even though firms have growth opportunities, they may not undertake new investment due to increased uncertainties and a lack of financing. Therefore, our first hypothesis is:

**H1**: Investments of private firms decline following the onset of the financial crisis.

Financing of investment comes either from internal sources (operating income, retained earnings) or external sources (new equity, borrowing), or a combination of both. Firms must evaluate and choose the most appropriate source of finance as different sources have their own benefits and costs. Existing theoretical models of adverse selection and moral hazard advocate the cost advantages of internal finance over external finance for companies which face uncertain prospects and operate in imperfect capital markets (Wang, 2010; Yang et al., 2009). Although the common theoretical principles underlying the financing decisions of large listed firms also apply to private firms, Du et al. (2015) describe financing choices as among the most challenging and problematic decisions faced by SMEs. According to the pecking order theory, a firm has a clear order of preference for financing: firstly, internally generated finance, then debt, and finally, equity (Agliardi et al., 2016). The theory argues that, because of the costs associated with information asymmetry, agency problems, and control restrictions between owners and managers, firms tend to use internal finance over external finance. If external finance is required, debt is preferred over
equity. Many studies (Degryse et al., 2012; Gregory et al., 2005; Sogorb Mira, 2005) consider the pecking order theory as more relevant for SMEs.

How is the financing behavior of a firm related to its investment? Market imperfections usually lead a firm’s investment and financing decisions to interact with each other. One of the first studies that examines the effect of market imperfections on investment is that of Fazzari et al. (1988). The authors argue that an increase in asymmetric information causes an increase in the cost of acquiring external finance (e.g., issuing new debt or new equity). Firms have therefore an incentive to use internal finance for investment. It is only when internal finance is not sufficient, firms need to use externally generated finance to continue its investment. Hence, investment of a firm substantially depends on its internally generated funds.

Small and medium-sized firms are particularly dependent on banks for external finance (Berger and Udell, 1998; Petersen and Rajan, 1994). A small fluctuation in the supply of bank finance would have a significant impact on their investments. Bigelli et al. (2014) argue that private firms are generally characterized by higher debt ratios and a higher proportion of short-term debt compared to long-term debt. When a financial crisis is underway, these firms face higher financial constraints because of increased difficulties to access alternative sources of finance (Akiyoshi and Kobayashi, 2010). Consequently, internally generated funds become a distinct financing source for private firms during the financial crisis. These firms will be highly dependent on internal finance to fuel their investments. Therefore, our second hypothesis is:

**H2:** Investments of private firms become more dependent on internal finance than external finance as a result of the financial crisis.
3. Methodology

We use the standard investment model that includes a firm’s cash flow, size and growth opportunity as the main explanatory variables to test our hypotheses (Badertscher et al., 2013; Yang et al., 2009). We estimate the following fixed effects regression model:

\[
Investment_{it} = \alpha + \beta_1 \text{Crisis} + \beta_2 \text{Post-crisis} + \beta_3 \text{Cash Flow}_{it} + \beta_4 \text{Size}_{it} + \\
\beta_5 \text{Growth}_{it} + \text{Firm}_i + \varepsilon_{it}, \quad (1)
\]

where the subscript \(i\) denotes individual firms, and \(t\) denotes different years. \(\text{Crisis}\) is a dummy variable equal to 1 for the period 2008–2009, and 0 otherwise; and \(\text{Post-crisis}\) is a dummy variable equal to 1 for the period 2010–2012, and 0 otherwise. For Hypothesis 1, we test the two regression coefficients \(\beta_1\) and \(\beta_2\) to see whether firm investment is significantly different in the crisis and post-crisis period.

We measure investment using four robust constructs. \(\text{Investment}_1\) is computed as the annual change in fixed assets plus depreciation (Firth et al., 2012). \(\text{Investment}_2\) is calculated as the annual increase in fixed assets plus depreciation (Badertscher et al., 2013). The difference between \(\text{Investment}_1\) and \(\text{Investment}_2\) is that the former includes reduction/sale of fixed assets (negative investment) while the latter variable considers only the increase/purchase of fixed assets. Another way to measure investment is based on tangible fixed assets (Akbar et al., 2013; Guariglia, 2008) and intangible fixed assets (Bigelli et al., 2014). Since most of the private firms in our sample do not disclose information on intangible fixed assets, we define investment variables based on tangible fixed assets. \(\text{Investment}_3\) is computed as the annual change in tangible fixed assets plus depreciation (Mortal and Reisel, 2013) and \(\text{Investment}_4\) is computed as the annual increase in
tangible fixed assets plus depreciation (Asker et al., 2015; Badertscher et al., 2013). All values are divided by total assets at the beginning of the year.

*Cash Flow* and *Growth* are the two widely used variables to explain firm investment. We define *Cash Flow* as operating income plus depreciation divided by total assets at the start of the year (Duchin et al., 2010). Following prior research on SMEs (Honjo and Harada, 2006; Rahaman, 2011), the variable *Growth* is defined as the rate of annual growth in employment. We include firm size (*Size*) as an influential control variable. *Size* is defined as the natural logarithm of total assets. Since commercial banks usually consider the size of a business an important criterion for financing decisions, and investments of smaller firms can be significantly different compared to those of larger firms, it is important to account for this effect. All explanatory and control variables are calculated at the beginning of the year to mitigate endogeneity problems. All variables used in the study are defined in Table 1.

[Insert Table 1]

We analyze a long time period covering the years before, during, and after the financial crisis. The presence of panel data has the advantage that we can control for all time-invariant firm-specific factors, observed as well as unobserved ones, by using firm fixed effects (Bastos and Pindado, 2013). To find the appropriate panel estimator we first use the Breusch and Pagan test statistic to compare random effects with standard ordinary least squares regression and then use the Hausman test to compare the random effects with the fixed effects model. It turns out that the fixed effects panel estimation is most appropriate for our analysis. Prior studies examining the
investment behavior of small and private firms also used fixed effects estimation method (Akbar et al., 2013; Vermoesen et al., 2013).

To examine whether the financial crisis has led to a change in the way internal and external financing influence investment, we use a slightly modified version of specification (1) and estimate the following regression model:

\[
\text{Investment}_{it} = \alpha + \beta_1 \text{Crisis (Post-crisis)} + \beta_2 \text{Internal Finance}_{it} + \beta_3 \text{External Finance}_{it} \\
+ \beta_4 \text{Internal Finance}_{it} \ast \text{Crisis (Post-crisis)} + \beta_5 \text{External Finance}_{it} \ast \text{Crisis (Post-crisis)} + \beta_6 \\
\text{Size}_{it} + \beta_7 \text{Growth}_{it} + \text{Firm}_i + \epsilon_{it} \quad (2)
\]

This regression model is estimated separately for the crisis period and the post-crisis period. The coefficients of interest are the two interaction coefficients \( \beta_4 \) and \( \beta_5 \), which capture the change in the effect of internal and external finance on firm’s investment during the crisis (post-crisis) period. We apply the Wald test to compare whether the marginal impact of the two different financing sources is statistically different from each other.

We define internal finance as income after-tax plus depreciation over beginning-of-year total assets (Guariglia, 2008). To be consistent with the definition of internal finance, we use net bank debt as the measure of external finance which is defined as the change in bank debt over beginning-of-year total assets (Nguyen et al., 2015).\(^3\)

To get an insight on the magnitude of the effect of the financing sources, we also conduct separate regressions across different sub-periods, instead of interacting the financing variables with the crisis and post-crisis dummies. This approach has the advantage that the parameters of

\[^3\] We did not include new equity issues as part of external finance because prior studies indicate bank credit as the main source of external finance for SMEs (Petersen and Rajan, 1994; Berger and Udell, 1998; Beck et al., 2008).
control variables vary across different periods, and show the effect of financing under different periods (Rousseau and Kim, 2008).

To verify the robustness of fixed effects estimation results, we re-run our tests with pooled ordinary least squares (OLS) regressions. A concern for potential endogeneity of investment with respect to internal finance nevertheless remains. We, therefore, adopt the two-stage least squares (2SLS) regressions method. In the first stage regression, we use previous year’s internal finance as an instrument. The predicted internal finance from the first stage estimation is used as the independent internal finance in the second stage equation.

4. Data

We collect financial statement data of Dutch private firms over the period 2004-2012 from Bureau van Dijk’s REACH database. Laeven and Valencia (2012) state that the global financial crisis started in 2008 in most European countries, whereas the inception of the crisis was in 2007 for USA and UK. We consider the years 2008-2009 as the period of the financial crisis and the years 2010-2012 as the post-crisis period.

We follow the definition of the European Commission which classifies a firm into a small category when it has between 10 – 49 employees and €2 – €10 million revenue or total assets, and medium category when it has between 50–249 employees with maximum €50 million revenue or €43 million total assets. A firm is included in the sample only when it satisfies at least two of these three conditions (employee number, revenue, and total assets) over the pre-crisis period. We did not identify and include firms as SMEs from the crisis and post-crisis periods in the sample because a firm may become an SME due to the adverse effect of the financial crisis whereas the main
Objective of our study is to investigate the investment behavior of SMEs during the crisis. Thus, no new firms enter the sample during and after the crisis period. Since a few firms have missing information during the crisis and the post-crisis periods, we do not have a balanced panel.

As common in the literature, firms operating in the financial sector (banks, insurance companies, public investment trusts), nonprofit organizations and governmental enterprises are excluded from the analysis because non-business considerations primarily influence their decisions. Following Duchin et al. (2010) and Vermoesen et al. (2013), firms whose total assets become doubled in one of the years of the sample period and firms with negative equity are excluded to omit the effects of mergers and acquisitions or other significant restructurings. Firms with consolidated accounts are analyzed to allow a comparison across the results of prior studies. The final sample of the study includes 469 private firms. We winsorize all firm-specific variables at the 1st percentile in each tail to exclude the influence of outliers.

Table 2 presents the industrial distribution of the firms in the sample. The largest category of the sample consists of wholesale and retail firms (26 percent). A substantial number of firms are operating in heavy manufacturing (21 percent), construction (20 percent), light manufacturing (16 percent), and transportation (11 percent) industries. The other category of only 2 percent firms consists of private firms from the agricultural and mining sector.

4.1 Summary statistics
For the full period (2004 – 2012) and all firms in the sample, we find that investment, as a percentage of total assets, ranges from 4.4 percent to 7.7 percent for the mean and 2.2 percent to 4.3 percent for the median. These are slightly lower than those of the Belgian SMEs with 7.9 percent for the mean and 5.1 percent for the median reported by Vermoesen et al. (2013), probably due to our longer sample period and our scaling with beginning-year total assets. We present the summary statistics (the means and the medians) of all variables separately for the pre-crisis, crisis, and post-crisis periods in Table 3. We also present the differences of these variables across sub-periods. The variables expressed in ratios are presented in Panel A. We observe that Dutch SMEs invest ($Investment_1$) on average 4.2 percent of their assets during the crisis period, which is a decline of 1.3 percent from the pre-crisis period. Firm investment continues to decline by 0.7 percent in the post-crisis period, a total decline of 2 percent compared to the pre-crisis period.

[Insert Table 3]

The average firm has External Finance (change in bank debt over total assets) of 4.1 percent in the pre-crisis period. Looking at the effect of the financial crisis, we see that External Finance significantly declined by 4.8 percent from the pre-crisis period. The median figure also indicates a significant decline (4.4 percent). The corresponding reduction in Internal Finance is lower (mean = 2.2 percent; median = 2.3 percent). Additional calculations indicate that the sample firm has on average 55.5 percent bank finance (sum of short-term and long-term bank debt over total assets)$^4$, compared to 34 percent in the UK, reflecting the difference between a bank-based and market-based financial system. Our finding is in line with that of de Goeij and Duffhues

$^4$ Not reported in the table.
(2010). They analyze several pre-crisis years and document that in the Netherlands, SMEs are financed more by debt relative to large firms. The fact that more than half of the assets of Dutch SMEs are financed by banks indicates the difficulty for SMEs to access public capital markets and their limited availability of internal finance.

The summary statistics of variables defined in levels are presented in Panel B. The average (median) level of firm investment ($Investment_1$), measured by the change in fixed assets including depreciation, changes from €822 thousand before the crisis to €662 thousand during the crisis and €602 thousand after the crisis. Looking at the effect of the financial crisis, we observe that the average firm acquires new bank debt of €344 thousand before the crisis, but during the crisis, the firm retires its bank debt by €242 thousand. The finding is in line with that of Psillaki and Eleftheriou (2015) who examine a sample of French SMEs and document that their access to external financing sources underwent a significant change during the financial crisis. The amount of internal finance also declines from €1547 thousand before the crisis to €1409 thousand during the crisis.

### 4.2 Correlation

In Table 4, the Pearson correlation coefficients between the variables are presented. By definition, the change and the increase (namely, the positive change) in assets are perfectly correlated, as can be seen between $Investment_1$ and $Investment_2$, and between $Investment_3$ and $Investment_4$. The change in fixed assets and the change in tangible fixed assets are also highly correlated. Investment has, as expected, a significant positive correlation with $Cash flow$ and $Growth$. We also observe that SMEs which invest more tend to use more bank debt (correlation =
0.35) and more internal finance (correlation = 0.23). Internal Finance has a low correlation with External Finance (correlation = 0.09).

[Insert Table 4]

The correlations among the independent variables are generally low (the highest correlation is 0.19) suggesting that multicollinearity is not a serious concern in our study. Yet, in most empirical analysis, the inclusion of several variables into a single regression raises the concern of multicollinearity, which may lead to spurious results (Francis et al., 2012). We perform Variance Inflation Factor (VIF) - a widely used measure to identify the degree of multicollinearity. According to Gujarati (2012), a VIF value greater than 10 indicates multicollinearity. Almeida and Eid (2014) use a VIF less than 5 as an indication of no multicollinearity. The VIF calculated for each independent variable included in our models is less than 2, which is well below the threshold indicator. Multicollinearity is, therefore not a serious issue in our study.

5. Empirical Results

We first investigate whether private SMEs in the Netherlands experienced a significant reduction in investment due to the financial crisis. Table 5 presents the empirical results. Model (1) is the baseline regression with Crisis, Post-crisis and firm fixed effects only, whereas Model (4) is the extended regression with all three firm-level control variables (Cash flow, Size, and Growth) on top of Crisis, Post-crisis and firm fixed effects. Overall, the results reveal a statistically significant decline in investment during and after the financial crisis. Model (4) shows that annual
investment as a percentage of total assets for an average firm declined by 1.8 percentage points during the crisis and by 2.3 percentage points in the post-crisis period. From all the regression results presented in Table 5, we can conclude that investment of private firms in the Netherlands were clearly hit by the financial crisis. The results support Hypothesis 1. The finding is in line with that of Vermoesen et al. (2013) who examined SMEs from Belgium, and Akbar et al. (2013) who investigated private firms from the UK.

[Insert Table 5]

In all regressions, the variables *Cash Flow*, *Size*, and *Growth* have significantly positive coefficients. Overall, these results suggest that firms with high cash flow and high growth, and large SMEs undertake a higher level of investment. The adjusted $R^2$ for the regression that includes all variables (Model 4) is 17 percent, which is slightly higher than that of Vermoesen et al. (2013) and similar to that reported by Akbar et al. (2013). The F-statistics across all models are statistically significant, indicating that the estimated models explain well the variation in firm investment.

We next proceed to examine hypothesis 2: whether the two financing sources (Internal Finance and External Finance) differentially influence investments of small- and medium-sized enterprises during the crisis and post-crisis periods. Therefore, we perform regressions interacting both financing sources with crisis and post-crisis dummies. We present these results in Table 6, Panel A.

In Models (1) and (2), we observe negative and statistically significant interaction coefficients of *Internal Finance * Crisis. The results show that the effect of internal financing on investment declines significantly during the crisis. On the other hand, we do not find any
significant change in the impact of external financing on investment during the crisis period, as can be seen from the statistically insignificant coefficients of \( \text{External Finance} \times \text{Crisis} \). Conducting the Wald test on these two interaction coefficients (\( p\)-values = 0.001 and 0.001) leads us to conclude that the marginal impact of internal financing on firm’s investment during the crisis is significantly smaller than that of external financing during the crisis. In other words, firms become less dependent on internal finance than external finance during the crisis.

We now examine whether investment is more dependent on internal finance in the post-crisis period (2010-2012). Models (3) and (4) present the result. In both models, the interaction coefficients of \( \text{Internal Finance} \) with \( \text{Post-crisis} \) dummy show a significant positive impact. However, the effect of external finance during the post-crisis period remains unchanged. The Wald tests (\( p\)-values = 0.203 and 0.139) show that the differences between the coefficients of \( \text{Internal Finance} \times \text{Post-crisis} \) and \( \text{External Finance} \times \text{Post-crisis} \) in Models (3) and (4) are statistically insignificant. Thus, we conclude that the marginal impact of the two financing sources on investment during the post-crisis period is not different from each other. Based on the results for the crisis and post-crisis periods, we reject Hypothesis 2.

[Insert Table 6]

As an alternative way to examine which financing source, internal or external, is more influential on investment, we perform separate regressions for the pre-crisis, crisis, and post-crisis periods. These results are presented in Table 6, Panel B. Prior to the financial crisis, we observe a positive relationship between internal finance and investment (Models 1, 3 and 4), as well as external finance and investment (Models 2, 3 and 4). During the crisis period, \( \text{Internal Finance} \) is
no more related to Investment (Models 5, 7, and 8). But investment is still significantly determined by external finance (Models 6, 7, and 8). The post-crisis period results (Models 9, 10, 11, and 12) are analogous to the pre-crisis period: both Internal Finance and External Finance show a significant positive relationship with Investment.

Altogether, these findings are consistent with those reported in Panel A. The financial crisis has significantly reduced the influence of internal financing on investments of SMEs, but has not changed the significant positive relationship of external financing with the investment. Although the finding is not in line with our hypothesis, it is quite plausible that private firms may not be willing to spend internal funds when the financial crisis makes investments so uncertain. These firms usually have owners with large and concentrated shareholdings who are less diversified and tend to behave in a risk averse manner. While facing uncertainty due to the financial crisis, these shareholders may not be willing to provide new financing to undertake investments unless they are backed by debtholders.

5.1 Additional analysis

The previous results are obtained from employing panel regression with fixed effects estimations. We now examine if the results related to Hypothesis 2 are robust to alternative estimation techniques. The ordinary-least-squares (OLS) regression results are presented in Table 7 (Models 1 and 2). These results are similar to what we obtained earlier. Model (1) shows that the effect of internal financing on firm investment declines significantly during the crisis period. The Wald test (p-value = 0.007) confirms a significant lower marginal impact of internal finance on investment relative to external finance during the crisis. In Model (2), we compare the effect of
the two financing sources in the post-crisis period. The Wald test (p-value = 0.308) does not indicate a differential marginal impact of internal and external finance on investment.

[Insert Table 7]

We estimate two-stage-least-squares (2SLS) regression to address the endogeneity concern between investment and internal finance. We use the previous year’s internal finance as an instrument. The F-test for this instrument is statistically significant, indicating the validity of the chosen instrument. The predicted value of internal finance from the first stage estimation is used as the independent variable in the second stage equation. The results, presented in Models (3) and (4) of Table 7, are similar to those obtained from fixed effects and OLS regressions. We find that the influence of internal finance on investment has significantly reduced during the crisis period. But we do not observe a significantly different impact during the post-crisis period.

We re-examine our results distinguishing between manufacturing and non-manufacturing firms; high- and low-levered firms (those above/below the 50th percentile of the distribution); large and small firms (those with total assets above/below the 50th percentile); and high and low cash flow firms (those above/below the 50th percentile). The results show that the negative effect of the financial crisis on investment does not differ between different sub-samples, except that the effect is reduced for high-levered firms.5 We also investigate the relative effects of Internal Finance and External Finance separately for the three periods. There we find similar findings, except for the high and low levered firms. We examine the interaction terms of each crisis year and the two

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5 Because the results are qualitative very similar, we do not present these and some other results in separate tables for the sake of brevity. These are available from authors on request.
financing sources (internal finance and external finance) and find qualitatively similar results to those obtained earlier.

As a final robustness check, we measure firm investment in three alternative ways. *Investment_2* is the positive change in fixed assets plus depreciation over beginning-of-year total assets. *Investment_3* is the change in tangible fixed assets plus depreciation over beginning-of-year total assets. *Investment_4* is the positive change in tangible fixed assets plus depreciation over beginning-of-year total assets. Table 8 presents the results on Hypothesis 1. All regression results confirm the earlier finding that firm investment declined significantly during and after the financial crisis.

The regression results related to Hypothesis 2 are shown in Table 9. The results of all models across various investment definitions are consistent with earlier findings reported in Table 6 (Panel A). The statistically significant Wald tests (p values = 0.016, 0.002, 0.009 in Models 1, 3, and 5 respectively) confirm that internal finance is less influential on investment compared to external finance during the financial crisis.

Like before, we also perform separate regressions for the pre-crisis, crisis, and post-crisis periods to examine whether internal or external finance differentially influence firm investment. These results are presented in Panel B. We do not observe any contradictory finding. Investment is significantly determined by external finance during the crisis period.

[Insert Tables 8 and 9]
6. Discussion and conclusion

Throughout the last years, many European countries have constantly been witnessing different repercussions of the financial crisis. Practitioners and policymakers are very much concerned with the effect of the crisis for private businesses, given the fact that an influential growth driver of the real economy is the large set of small- and medium-sized enterprises. In this paper, we specifically focus on the investment behavior of these firms. We examine whether private firms have reduced the amount of investment in fixed assets due to the financial crisis.

Another aftermath of the crisis was that commercial banks started to limit the supply of credit to firms. Credit constraints made it necessary for businesses to search for alternative sources of finance. Given the inability to access the capital market, internal financing is the most obvious alternative available to private firms. To what extent the decline in bank credit and the use of internal financing have affected the investments of private firms has not yet been explored. This paper attempts to fill this void too.

We construct a unique dataset of 469 private firms in the Netherlands, covering a long time-period (2004-2012). This relatively large dataset enables us to make a statistically reliable comparison of the crisis period (2008-2009) and the post-crisis period (2010-2012) relative to the pre-crisis period (2004-2007). Our results show that small- and medium-sized firms significantly cut back investment expenditures ever since the onset of the financial crisis. The univariate analysis reveals that investment per annum declined on average by 1.3 percent of total assets during the crisis and 2 percent after the crisis. The multivariate analysis that controls for various firm characteristics like cash flows, size, and growth also indicate a significant reduction in investment.
The results of our study also show that the type of financing is an important determinant of corporate investment. Specifically, we find a significant positive impact of both internal and external financing on the investments of private firms in the pre-crisis and post-crisis periods. In contrast, during the crisis, internal financing has no impact on the investment of SMEs, whereas external financing remains a significant determinant. Our findings suggest that investments of private firms during the financial crisis are more determined by their external financing sources than by their internal financing sources. We conduct a series of additional robustness checks using alternative estimation techniques and measurement of variables. We also analyze the sub-samples of firms based on manufacturing status, debt usage, firm size, and cash flows. None of these tests reveal a contradictory result. Taken together, we show the internal funds generated by firms are not a determining factor for the investments of SMEs during the financial crisis, while the supply of bank finance remains influential on firm investment during the crisis. Our finding suggests that the policymakers should be particularly concerned with ensuring bank lending to SMEs during the economic crisis to mitigate a damaging effect on the investments of private firms.

One might argue that investments of SMEs declined during the financial crisis not because of the supply effect but due to the demand effect (firm’s demand for bank finance has decreased). Anecdotal evidence does not provide support for this conjecture. Hebbink et al. (2014) observe that in the Netherlands conditions to grant loans have been revised on a regular basis since mid-2007 and led commercial banks to limit their supply of credit and charge higher interest for new loans. According to the Centraal Bureau voor de Statistiek (Central Agency for Statistics), the proportion of rejected bank loan applications in the Netherlands has increased from 7 percent in 2007 to 32 percent in 2012.6 It compares to 15 percent average rejection rate for the euro area

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6 http://www.cbs.nl/en-GB/menu/themas/dossiers/eu/publicaties/archief/2011/2011-3495-wm.htm
The higher rate of loan rejection indicates that the demand for bank credit was greater than the supply. Analyzing SMEs from the UK during the financial crisis, Cowling et al. (2012) also document that larger firms experienced a higher demand for external finance. Thus, it is reasonable to believe that investments of private firms were affected by the supply of bank finance during the financial crisis.

We should also mention that our study is not without limitations. We do not know why the internal finance becomes less influential during the crisis when external finance is difficult to access. Were private firms prepared to incur more costs and get external financing in order to preserve internal funds to meet unforeseen contingencies of the crisis? One way to shed light on this issue could be to undertake a qualitative study involving survey or interview of owner/managers of firms. Another possibility could be to compare with a control group of firms that did not use external financing before and after the crisis. Future research can examine these issues. Our study also did not examine (because of lack of data) the specific characteristics of private firms before the crisis that make them more prone to keep investing during the crisis, and vice versa. This could be relevant for policymakers to see where to intervene to sustain business investment. Another limitation of the study comes from its focus on one country and our hesitation to generalize the applicability of the results to other countries. However, we believe that our findings would be applicable to the European private SMEs which operate in a bank-based financial system. Although collecting data of private enterprises is a colossal task, future research using cross-country data can yield interesting results.
References

Agliardi, E., Agliardi, R. & Spanjers, W. (2016). Corporate financing decisions under ambiguity: Pecking order and liquidity policy implications. *Journal of Business Research, 69*, 6012-6020.

Akbar, S., Rehman, S., & Ormrod, P. (2013). The impact of recent financial shocks on the financing and investment policies of UK private firms. *International Review of Financial Analysis, 26*, 59–70.

Akiyoshi, F., & Kobayashi, K. (2010). Banking crisis and productivity of borrowing firms: Evidence from Japan. *Japan and the World Economy, 22*, 141–150.

Almeida, H., Campello, M., & Laranjeira, B. (2011). Corporate debt maturity and the real effects of the 2007 credit crisis. *Critical Finance Review, 1*, 3–58.

Almeida, J.R., & Eid Jr., W. (2014). Access to finance, working capital management and company value: evidences from Brazilian companies listed on BM & FBOVESPA. *Journal of Business Research, 67*, 924–934.

Asker, J., Farre-Mensa, J., & Ljungqvist, A. (2015). Corporate investment and stock market listing: a puzzle? *Review of Financial Studies, 28*, 342–390.

Ayyagari, M., Beck, T., & Demirgüç-Kunt, A. (2007). Small and medium enterprises across the globe. *Small Business Economics, 29*, 415–434.

Badertscher, B., Shroff, N., & White, H. (2013). Externalities of public firm presence: Evidence from private firms’ investment decisions. *Journal of Financial Economics, 109*, 682–706.

Becchetti, L., Castelli, A., & Hasan, I. (2010). Investment–cash flow sensitivities, credit rationing and financing constraints in small and medium-sized firms. *Small Business Economics, 35*, 467–497.

Beck, T., Demirgüç-Kunt, A., & Maksimovic, V. (2008). Financing patterns around the world: are small firms different? *Journal of Financial Economics, 89*, 467–487.

Bastos, R., & Pindado, J. (2013). Trade credit during a financial crisis: A panel data analysis. *Journal of Business Research, 66* (5), 614–620.

Berger, A., & Udell, G. (1998). The economics of small business finance: The roles of private equity and debt markets in the financial growth cycle. *Journal of Banking & Finance, 22*, 613–674.

Bigelli, M., Martín-Ugedo, J., & Sánchez-Vidal, F. (2014). Financial conservatism of private firms. *Journal of Business Research, 67*, 2419-2427.
Bo, H., Driver, C., & Lin, H. C. (2014). Corporate investment during the financial crisis: Evidence from China. *International Review of Financial Analysis, 35*, 1–12.

Campello, M., Graham, J., & Harvey, C. (2010). The real effects of financial constraints: Evidence from a financial crisis. *Journal of Financial Economics, 97*, 470–487.

Chen, H. J., & Hsu, H. T. (2005). The role of firm size in controlling output decline during the Asian financial crisis. *Journal of Economic Development, 30*, 103–129.

Cowling, M., Liu, W., & Ledger, A. (2012). Small business financing in the UK before and after the financial crisis. *International Small Business Journal, 30*, 778–800.

Danielson, M., & Scott, J. (2007). A note on agency conflicts and the small firm investment decision. *Journal of Small Business Management, 45*, 157–175.

Degryse, H., de Goeij, P., & Kappert, P. (2012). The impact of firm and industry characteristics on small firms’ capital structure. *Small Business Economics, 38*, 431–447.

de Goeij, P., & Duffhues, P. (2010). *Het investerings/financieringsgedrag van rechtspersoonlijkheid bezittende ondernemingen*. CentER Applied Research, Tilburg University, 172.

de la Torre, A., Martínez Pería, M., & Schmukler, S. (2010). Bank involvement with SMEs: Beyond relationship lending. *Journal of Banking & Finance, 34*, 2280–2293.

Du, J., Guariglia, A., & Newman, A. (2015). Do social capital building strategies influence the financing behavior of Chinese private small and medium-sized enterprises? *Entrepreneurship Theory and Practice, 39*, 601–631.

Duchin, R., Ozbas, O., & Sensoy, B. (2010). Costly external finance, corporate investment, and the subprime mortgage credit crisis. *Journal of Financial Economics, 97*, 418–435.

ECB. (2012). Survey on the access to finance of small and medium-sized enterprises in the Euro area. Available at: (http://www.ecb.int/pub/pdf/other/accesstofinancesmallmediumsizedenterprises201211en.pdf.)

Fazzari, S., Hubbard, R., & Petersen, B. (1988). Financing constraints and corporate investment. *Brookings Papers on Economic Activity, 1*, 141–195.

Firth, M., Malatesta, P.J., Xin, Q., & Xu, L. (2012). Corporate investment, government control, and financing channels: evidence from China's listed companies. *Journal of Corporate Finance 18*, 433–450.

Francis, B., Hasan, I., & Wu, Q. (2012). Do corporate boards matter during the current financial crisis? *Review of Financial Economics, 21*, 39–52.
Gregory, B., Rutherford, M., Oswald, S., & Gardiner, L. (2005). An empirical investigation of the growth cycle theory of small firm financing. *Journal of Small Business Management, 43*, 382–392.

Guariglia, A. (2008). Internal financial constraints, external financial constraints, and investment choice: Evidence from a panel of UK firms. *Journal of Banking & Finance, 32*, 1795–1809.

Gujarati, D. (2012). *Basic Econometrics*. International edition. New York: McGraw Hill.

Hebbink, G., Kruidhof, M., & Sligenberg, J. (2014). Bank lending and capital. *DNB Occasional Studies* 12.

Honjo, Y., & Harada, N. (2006). SME policy, financial structure and firm growth: Evidence from Japan. *Small Business Economics, 27*, 289–300.

Kahle, K., & Stulz, R. (2013). Access to capital, investment, and the financial crisis. *Journal of Financial Economics, 110*, 280–299.

Kasahara, T. (2008). Severity of financing constraints and firms’ investments. *Review of Financial Economics, 17*, 112–129.

Kim, D., Lee, Y., & Park, K. (2002). Credit crunch and shocks to firms: Korean experience under the Asian financial crisis. *Emerging Markets Review, 3*, 195–210.

Kirchhoff, B., Newbert, S., & Hasan, I. (2007). The influence of university R&D expenditures on new business formations and employment growth. *Entrepreneurship Theory and Practice, 31*, 543–559.

Laeven, L. & Valencia, F. (2012). Systemic banking crises database: An update. *IMF Working Paper No. 12/163*.

Lee, S., Park, G., & Yoon, B. (2010). Open innovation in SMEs – an intermediated network model. *Research Policy, 39*, 290–300.

López-Gracia, J., & Mestre-Barberá, R. (2011). Tax effect on Spanish SME optimum debt maturity structure. *Journal of Business Research, 64*, 649-655.

Michaelas, N., Chittenden, F., & Poutziouris, P. (1999). Financial policy and capital structure choice in UK SMEs: Empirical evidence from company panel data. *Small Business Economics, 12*, 113–130.

Mortal, S., & Reisel, N. (2013). Capital allocation of public and private firms. *Journal of Financial and Quantitative Analysis, 48*, 77–103.

Nguyen, T., Nguyen, H., & Xiangkang, Y. (2015). Corporate governance and corporate financing and investment during the 2007-2008 financial crisis. *Financial Management, 44*, 115–146.
Ogawa, K., & Tanaka, T. (2013). The global financial crisis and small- and medium-sized enterprises in Japan: how did they cope with the crisis. *Small Business Economics, 41*, 401–417.

Petersen, M., & Rajan, R. (1994). The benefits of lending relationships: Evidence from small business data. *Journal of Finance, 49*, 3–37.

Psillaki, M., & Eleftheriou, K. (2015). Trade credit, bank credit, and flight to quality: evidence from French SMEs. *Journal of Small Business Management, 53*, 1219–1240.

Rahaman, M. (2011). Access to financing and firm growth. *Journal of Banking & Finance, 35*, 709–723.

Rousseau, P., & Kim, J. (2008). A flight to Q? Firm investment and financing in Korea before and after the 1997 financial crisis. *Journal of Banking & Finance, 32*, 1416–1429.

Sogorb Mira, F. (2005). How SME uniqueness affects capital structure: Evidence from a 1994-1998 Spanish data panel. *Small Business Economics, 25*, 447–457.

Vermoesen, V., Deloof, M., & Laveren, E. (2013). Long-term debt maturity and financing constraints of SMEs during the global financial crisis. *Small Business Economics, 41*, 433–448.

Wang, D. (2010). Corporate investment, financing, and dividend policies in the high-tech industry. *Journal of Business Research, 63*(5), 486–489.

Yang, C., Baker, H., Chou, L, & Lu, B. (2009). Does switching from NASDAQ to the NYSE affect investment cash flow sensitivity? *Journal of Business Research, 62*(10), 1007-1012
| Variables     | Definitions                                                                                                                                 |
|---------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Investment_1  | Change in fixed assets plus depreciation over beginning-of-year total assets                                                              |
| Investment_2  | Increase in fixed assets plus depreciation over beginning-of-year total assets                                                             |
| Investment_3  | Change in tangible fixed assets plus depreciation over beginning-of-year total assets                                                      |
| Investment_4  | Increase in tangible fixed assets plus depreciation over beginning-of-year total assets                                                    |
| Cash Flow     | Operating income plus depreciation over beginning-of-year total assets                                                                      |
| Internal Finance | Income after tax plus depreciation over beginning-of-year total assets                                                                    |
| External Finance | Change in bank debt over beginning-of-year total assets                                                                                   |
| Size          | Natural logarithm of the book value of total assets                                                                                       |
| Growth        | Logarithmic change in annual employment                                                                                                   |
| Crisis        | Dummy variable equal to 1 for the period 2008-2009, 0 otherwise                                                                             |
| Post-crisis   | Dummy variable equal to 1 for the period 2010-2012, 0 otherwise                                                                            |
| Industry                  | No. of firms | % of firms |
|---------------------------|--------------|------------|
| Agricultural and mining   | 10           | 2          |
| Construction              | 93           | 20         |
| Light manufacturing       | 73           | 16         |
| Heavy manufacturing       | 98           | 21         |
| Transportation            | 51           | 11         |
| Wholesale and retail trade| 121          | 26         |
| Services                  | 23           | 5          |
| **Total**                 | **469**      | **100**    |
Table 3  
Summary statistics

Panel A: Means, medians, and the differences of variables as defined in Table 1.

|                      | Pre-crisis (2004-2007) | Crisis (2008-2009) | Post-crisis (2010-2012) | Difference: Crisis – Pre-crisis | Difference: Crisis – Post-crisis |
|----------------------|------------------------|--------------------|-------------------------|-------------------------------|-------------------------------|
|                      | Mean   | Median  | Mean   | Median  | Mean   | Median  | Mean   | Median  | Mean   | Median  | Mean   | Median  | Mean   | Median  | Mean   | Median  | Mean   | Median  |
| Investment_1         | .055   | .031    | .042   | .019    | .035   | .016    | -.013* | -.012* | -.007  | -.003  |
| Investment_2         | .086   | .050    | .076   | .041    | .065   | .033    | -.010**| -.009* | -.011**| -.008* |
| Investment_3         | .053   | .029    | .042   | .019    | .033   | .015    | -.011**| -.010* | -.009**| -.004* |
| Investment_4         | .073   | .043    | .067   | .034    | .057   | .030    | -.006* | -.009* | -.010**| -.004* |
| Cash Flow            | .149   | .135    | .115   | .100    | .100   | .085    | -.034**| -.035* | -.015**| -.004* |
| Internal Finance     | .114   | .102    | .092   | .079    | .082   | .069    | -.022**| -.023* | -.010**| -.010* |
| External Finance     | .041   | .018    | -.007  | -.026   | .010   | -.003   | -.048**| -.044* | .017** | .023*  |
| Size                 | 9.479  | 9.513   | 9.598  | 9.614   | 9.592  | 9.630   | .119** | .101*  | -.006  | .016   |
| Growth               | .013   | .000    | -.004  | .000    | -.008  | -.006   | -.017**| .000*  | -.004  | -.006  |

** and * indicate significance at the 5 percent and 10 percent level, respectively.
Panel B: Means, medians, and the differences of variables expressed in thousands of Euros, except the number of employees.

|                      | Pre-crisis (2004-2007) | Crisis (2008-2009) | Post-crisis (2010-2012) | Difference: Crisis – Pre-crisis | Difference: Crisis – Post-crisis |
|----------------------|------------------------|---------------------|-------------------------|--------------------------------|-------------------------------|
|                      | Mean       | Median   | Mean       | Median   | Mean       | Median   | Mean       | Median   | Mean       | Median   | Mean       | Median   |
| Investment_1         | 821.92     | 349.00   | 661.88     | 251.00   | 601.61     | 199.5    | -160.04**  | -98.00** | -60.26     | -51.50   |
| Investment_2         | 1,260.89   | 575.50   | 1,227.17   | 534.50   | 1,095.29   | 505.00   | -33.71     | -41.00   | 131.88     | -29.50*  |
| Investment_3         | 768.31     | 332.00   | 694.75     | 258.00   | 552.99     | 203.00   | -73.57     | -74.00** | -141.75**  | -55.00** |
| Investment_4         | 1068.02    | 492.50   | 1,102.48   | 480.50   | 940.29     | 379.00   | 34.45      | -12.00   | -162.18**  | -101.50**|
| Cash Flow            | 2,010.26   | 1567.50  | 1,789.12   | 1468.00  | 1,644.05   | 1223.00  | -221.14**  | -99.50** | -145.06*   | -245.00**|
| Internal Finance     | 1,547.28   | 1191.00  | 1,409.13   | 1089.00  | 1,318.35   | 953.50   | -138.15**  | -102.00**| -90.78     | -135.50* |
| External Finance     | 344.52     | 208.00   | -241.86    | -353.00  | 66.99      | -56.5    | -585.39**  | -561.00**| 308.86**   | 296.50** |
| Size                 | 15,585.15  | 13535.00 | 17,455.63  | 14966.50 | 17,517.81  | 15216.00 | 1,870.48** | 1431.00**| 62.18      | 249.50   |
| No. of Employees     | 114        | 111      | 118        | 109      | 114        | 106      | 4          | -2       | 4          | -3       |

** and * indicate significance at the 5 percent and 10 percent level, respectively.
Table 4
Correlation matrix

|     | (1) Investment_1 | (2) Investment_2 | (3) Investment_3 | (4) Investment_4 | (5) Cash Flow | (6) Internal Finance | (7) External Finance | (8) Size | (9) Growth |
|-----|------------------|------------------|------------------|------------------|--------------|----------------------|----------------------|---------|------------|
| (1) | Investment_1     | 1                |                  |                  |              |                      |                      |         |            |
| (2) | Investment_2     | 1                | 1                |                  |              |                      |                      |         |            |
| (3) | Investment_3     | 0.87*            | 0.88*            | 1                |              |                      |                      |         |            |
| (4) | Investment_4     | 0.86*            | 0.90*            | 1                | 1            |                      |                      |         |            |
| (5) | Cash Flow        | 0.20*            | 0.15*            | 0.23*            | 0.15*        | 1                    |                      |         |            |
| (6) | Internal Finance | 0.23*            | 0.17*            | 0.25*            | 0.17*        | 0.95*                | 1                    |         |            |
| (7) | External Finance | 0.35*            | 0.38*            | 0.34*            | 0.34*        | 0.12*                | 0.09*                | 1       |             |
| (8) | Size             | 0.09*            | 0.11*            | 0.08*            | 0.10*        | -0.08*               | -0.09*               | 0.06*   | -0.001     |
| (9) | Growth           | 0.11*            | 0.08*            | 0.13*            | 0.08*        | 0.19*                | 0.15*                | 0.19*   | -0.001     |

The table shows the Pearson correlation coefficients for the full sample of firms. All variables are defined in Table 1. * indicates significance at the 5 percent level.
Table 5
Effect of the financial crisis on investment

|                | (1)        | (2)        | (3)        | (4)        |
|----------------|------------|------------|------------|------------|
| Crisis         | -0.014***  | -0.007*    | -0.017***  | -0.018***  |
|                | (-3.51)    | (-1.77)    | (-4.38)    | (-3.93)    |
| Post-crisis    | -0.020***  | -0.011***  | -0.022***  | -0.023***  |
|                | (-5.45)    | (-2.91)    | (-5.83)    | (-5.31)    |
| Cash Flow      |            |            |            |            |
|                | 0.172***   | 0.151***   | 0.100***   |            |
|                | (9.25)     | (8.26)     | (4.83)     |            |
| Size           |            |            |            |            |
|                |            |            | 0.082***   | 0.077***   |
|                |            |            | (11.70)    | (9.34)     |
| Growth         |            |            |            | 0.042*     |
|                |            |            |            | (1.65)     |
| Firm fixed effects | Yes    | Yes    | Yes    | Yes    |
| No. of Observations | 3960  | 3915  | 3915  | 3030  |
| Adjusted R²    | 0.112     | 0.133     | 0.166     | 0.170     |
| F-statistic    | 16.21     | 38.71     | 64.43     | 30.77     |
| P-value (F-statistic) | 0.000 | 0.000 | 0.000 | 0.000 |

The table reports the estimates of firm fixed effects regressions of Investment_1. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Table 6
Effect of internal and external finance on investment

Panel A: Interaction analysis

|                      | (1)              | (2)              | (3)              | (4)              |
|----------------------|------------------|------------------|------------------|------------------|
| Crisis               | 0.016***         | 0.018***         | -0.013***        | -0.019***        |
|                      | (3.35)           | (3.06)           | (-2.88)          | (-3.72)          |
| Post-crisis          |                  |                  |                  |                  |
|                      |                  |                  |                  |                  |
| Internal Finance     | 0.259***         | 0.218***         | 0.201***         | 0.142***         |
|                      | (11.34)          | (8.59)           | (8.38)           | (5.22)           |
| External Finance     | 0.200***         | 0.205***         | 0.199***         | 0.199***         |
|                      | (18.53)          | (16.31)          | (18.76)          | (15.96)          |
| Internal Finance * Crisis | -0.126***     | -0.158***        |                  |                  |
|                      | (-3.39)          | (-3.84)          |                  |                  |
| Internal Finance * Post-crisis | 0.073**        |                  | 0.099***         |                  |
|                      |                  |                  | (2.09)           | (2.58)           |
| External Finance * Crisis | 0.020          | 0.005            |                  |                  |
|                      | (0.92)           | (0.21)           |                  |                  |
| External Finance * Post-crisis | 0.020          | 0.030            |                  |                  |
|                      |                  | (0.88)           |                  | (1.21)           |
| Size                 |                  | 0.025***         | 0.024***         |                  |
|                      |                  | (3.17)           | (2.96)           |                  |
| Growth               |                  | -0.001           | -0.005           |                  |
|                      |                  | (-0.05)          | (-0.23)          |                  |
| Firm fixed effects   | Yes              | Yes              | Yes              | Yes              |
| No. of Observations  | 3901             | 3024             | 3901             | 3024             |
| Adjusted R²          | 0.249            | 0.272            | 0.248            | 0.272            |
| F-statistic          | 132.7            | 76.48            | 131.6            | 76.53            |
| P-value (F-statistic) | 0.000            | 0.000            | 0.000            | 0.000            |
| P-value (Wald test)  |                  |                  |                  |                  |
| for the difference   |                  |                  |                  |                  |
| of interaction       |                  |                  |                  |                  |
| coefficients for the |                  |                  |                  |                  |
| respective period    |                  |                  |                  |                  |
|                      | 0.001            | 0.001            | 0.203            | 0.139            |

The table reports the estimates of firm fixed effects regressions of Investment_1. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

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Panel B: Sub-periods analysis

|                           | Pre-crisis period (2004-2007) | Crisis period (2008-2009) | Post-crisis period (2010-2012) |
|---------------------------|-------------------------------|---------------------------|-------------------------------|
|                           | (1)  | (2)  | (3)  | (4)  | (5)  | (6)  | (7)  | (8)  | (9)  | (10) | (11) | (12) |
| Internal Finance          | 0.250*** | 0.207*** | 0.095* | 0.030 | 0.001 | -0.082 | 0.183*** | 0.195*** | 0.179*** |
|                           | (5.99) | (5.20) | (1.94) | (0.40) | (0.01) | (-1.04) | (3.23) | (3.60) | (3.54) |
| External Finance          | 0.183*** | 0.179*** | 0.144*** | 0.179*** | 0.184*** | 0.178*** | 0.199*** | 0.182*** | 0.200*** |
|                           | (12.68) | (12.33) | (7.59) | (7.73) | (7.80) | (5.18) | (9.68) | (8.67) | (8.73) |
| Size                      | 0.088*** | 0.049 | 0.109*** |
|                           | (4.77) | (1.07) | (4.99) |
| Growth                    | 0.013 | 0.107 | -0.128*** |
|                           | (0.36) | (1.40) | (-2.77) |
| Firm fixed effects        | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| No. of Observations       | 1842 | 1850 | 1840 | 1429 | 903 | 919 | 903 | 634 | 1158 | 1185 | 1158 | 961 |
| Adjusted R²               | 0.165 | 0.234 | 0.247 | 0.253 | 0.156 | 0.268 | 0.256 | 0.321 | 0.178 | 0.251 | 0.255 | 0.418 |
| F-statistic               | 35.85 | 160.9 | 95.73 | 38.68 | 0.160 | 59.72 | 30.53 | 16.36 | 10.43 | 93.79 | 43.37 | 43.94 |
| P-value (F-statistic)     | 0.000 | 0.000 | 0.000 | 0.000 | 0.6893 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |

The table reports the estimates of firm fixed effects regressions of Investment_1. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Table 7
Effect of internal and external finance on investment:
Robustness check with alternative estimation techniques

|                      | OLS          | 2SLS         |          |          |
|----------------------|--------------|--------------|----------|----------|
|                      | (1)          | (2)          | (3)      | (4)      |
| Crisis               | 0.020***     | 0.022***     |          |          |
| Post-crisis          | -0.018***    | -0.014**     | (-3.54)  | (-2.03)  |
| Internal Finance     | 0.223***     | 0.151***     | 0.310*** | 0.242*** |
|                      | (8.99)       | (5.61)       | (9.67)   | (6.59)   |
| External Finance     | 0.210***     | 0.208***     | 0.215*** | 0.211*** |
|                      | (10.29)      | (9.80)       | (16.09)  | (15.60)  |
| Internal Finance * Crisis | -0.166***  | -0.149**     | (-3.18)  | (-2.36)  |
| Internal Finance * Post-crisis | 0.093**    | 0.080        | (2.02)   | (1.32)   |
| External Finance * Crisis | 0.022      | 0.010        | (0.49)   | (0.37)   |
| External Finance * Post-crisis | 0.025      | 0.017        | (0.63)   | (0.69)   |
| Size                 | 0.012***     | 0.013***     | 0.015*** | 0.015*** |
|                      | (4.22)       | (4.37)       | (5.02)   | (5.05)   |
| Growth               | 0.015        | 0.009        | 0.002    | -0.0034  |
|                      | (0.54)       | (0.33)       | (0.06)   | (-0.10)  |
| No. of Observations  | 3024         | 3024         | 2710     | 2710     |
| Adjusted R²          | 0.172        | 0.170        | 0.159    | 0.171    |
| F-statistic          | 38.09        | 44.02        | 80.53    | 81.58    |
| P-value (F-statistic)| 0.000        | 0.000        | 0.000    | 0.000    |
| P-value (Wald test)  | 0.007        | 0.308        | 0.030    | 0.369    |
| F-statistic for instrument | 1465.87  | 1092.25      |          |          |
| P-value (F-statistic for instrument) | 0.000      | 0.000        |          |          |

The table reports the estimates of OLS and 2SLS regressions of Investment_1. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Table 8
Effect of the financial crisis on investment: Robustness check of alternative investment measures

|                | Investment_2 | Investment_3 | Investment_4 |
|----------------|--------------|--------------|--------------|
| (1)            | (2)          | (3)          |              |
| Crisis         | -0.017***    | -0.010***    | -0.009**     |
|                | (-3.24)      | (-2.60)      | (-2.21)      |
| Post-crisis    | -0.029***    | -0.020***    | -0.022***    |
|                | (-6.01)      | (-5.66)      | (-5.52)      |
| Cash Flow      | 0.061***     | 0.103***     | 0.059***     |
|                | (2.60)       | (6.10)       | (3.16)       |
| Size           | 0.093***     | 0.061***     | 0.062***     |
|                | (9.89)       | (9.04)       | (8.09)       |
| Growth         | 0.035        | 0.072***     | 0.055**      |
|                | (1.23)       | (3.48)       | (2.43)       |
| Firm fixed effects | Yes    | Yes          | Yes          |
| No. of Observations | 2315  | 3023         | 2394         |
| Adjusted $R^2$ | 0.210        | 0.237        | 0.280        |
| F-statistic    | 26.62        | 37.67        | 22.63        |
| P-value (F-statistic) | 0.000 | 0.000        | 0.000        |

The table reports the estimates of firm fixed effects regressions of Investment_2, Investment_3, and Investment_4. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
Table 9
Effect of internal and external finance on investment: Robustness check of alternative investment measures

Panel A: Interaction analysis

|                    | Investment_2 (1) | Investment_3 (2) | Investment_4 (3) | Investment_4 (4) | Investment_4 (5) | Investment_4 (6) |
|--------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Crisis             | 0.023*** (3.44) | 0.016*** (3.28) | 0.019*** (3.44) |                  |                  |                  |
| Post-crisis        | -0.020*** (-3.46) | -0.018*** (-4.27) | -0.018*** (-3.62) |                  |                  |                  |
| Internal Finance   | 0.178*** (6.34) | 0.117*** (3.87) | 0.190*** (9.03) | 0.134*** (5.98) | 0.142*** (6.00) | 0.091*** (3.63) |
| External Finance   | 0.222*** (16.57) | 0.210*** (15.58) | 0.151*** (14.55) | 0.155*** (14.96) | 0.150*** (13.43) | 0.146*** (13.13) |
| Internal Finance * Crisis | -0.138*** (-3.06) | -0.088** (-2.57) | -0.098** (-2.65) |                  |                  |                  |
| Internal Finance * Post-crisis | 0.055 (1.34) | 0.068** (2.13) | 0.050 (1.44) |                  |                  |                  |
| External Finance * Crisis | -0.006 (-0.22) | 0.041* (1.92) | 0.021 (0.90) |                  |                  |                  |
| External Finance * Post-crisis | 0.027 (1.01) | 0.012 (0.59) | 0.0210 (0.95) |                  |                  |                  |
| Size               | 0.028*** (3.32) | 0.035*** (3.95) | 0.019*** (2.98) | 0.023*** (3.51) | 0.018** (2.48) | 0.024*** (3.29) |
| Growth             | -0.009 (-0.34) | -0.018 (0.70) | 0.044** (2.26) | 0.036* (1.85) | 0.027 (1.24) | 0.019 (0.89) |
| No. of Observations | 2313           | 2313           | 3017           | 3017           | 2391           | 2391           |
| Adjusted R²        | 0.330           | 0.331           | 0.319           | 0.320           | 0.359           | 0.360           |
| F-statistic        | 70.07           | 70.63           | 74.02           | 75.14           | 52.44           | 53.18           |
| P-value (F-statistic) | 0.000           | 0.000           | 0.000           | 0.000           | 0.000           | 0.000           |
| P-value (Wald test) for the difference of interaction coefficients for the respective period | 0.016           | 0.556           | 0.002           | 0.148           | 0.009           | 0.484           |

The table reports the estimates of firm fixed effects regressions of Investment_2, Investment_3, and Investment_4. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.
## Panel B: Sub-periods analysis

|                      | Pre-crisis period (2004-2007) | Crisis period (2008-2009) | Post-crisis period (2010-2012) |
|----------------------|--------------------------------|---------------------------|--------------------------------|
|                      | Investment_2  | Investment_3  | Investment_4  | Investment_2  | Investment_3  | Investment_4  | Investment_2  | Investment_3  | Investment_4  |
|                      | (1)           | (2)           | (3)           | (4)           | (5)           | (6)           | (7)           | (8)           | (9)           |
| Internal Finance     | 0.041         | 0.078***      | 0.028         | 0.031         | 0.078         | 0.161*        | 0.037         | 0.157***      | 0.070         |
|                      | (0.76)        | (2.06)        | (0.66)        | (0.29)        | (1.14)        | (1.82)        | (0.65)        | (3.72)        | (1.35)        |
| External Finance     | 0.167***      | 0.107***      | 0.096***      | 0.153***      | 0.194***      | 0.172***      | 0.196***      | 0.139***      | 0.123***      |
|                      | (8.16)        | (7.20)        | (6.08)        | (3.34)        | (6.43)        | (4.28)        | (7.57)        | (7.29)        | (5.51)        |
| Size                 | 0.090***      | 0.059***      | 0.071***      | 0.043         | -0.012        | -0.038        | 0.115***      | 0.097***      | 0.136***      |
|                      | (4.68)        | (4.12)        | (4.63)        | (0.69)        | (-0.30)       | (-0.67)       | (4.21)        | (5.30)        | (5.61)        |
| Growth               | -0.012        | 0.047         | 0.038         | 0.290***      | 0.155**       | 0.277***      | -0.067        | -0.033        | -0.103**      |
|                      | (-0.31)       | (1.64)        | (1.21)        | (2.86)        | (2.36)        | (3.18)        | (-1.22)       | (-0.86)       | (-2.27)       |
| Firm fixed effects   | Yes           | Yes           | Yes           | Yes           | Yes           | Yes           | Yes           | Yes           | Yes           |
| No. of Observations  | 1134          | 1424          | 1180          | 471           | 632           | 494           | 708           | 961           | 717           |
| Adjusted R²          | 0.317         | 0.339         | 0.373         | 0.357         | 0.363         | 0.307         | 0.496         | 0.466         | 0.510         |
| F-statistic          | 37.75         | 34.69         | 26.57         | 11.45         | 20.09         | 13.24         | 33.87         | 37.33         | 29.37         |
| P-value (F-statistic)| 0.000         | 0.000         | 0.000         | 0.000         | 0.000         | 0.000         | 0.000         | 0.000         | 0.000         |

The table reports the estimates of firm fixed effects regressions of Investment_2, Investment_3, and Investment_4. All variables are defined in Table 1. t-statistics are reported in parentheses. ***, **, and * indicate statistical significance at the 1 percent, 5 percent, and 10 percent levels, respectively.