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Article

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BANKING & FINANCE | RESEARCH ARTICLE

Investment and financing behaviours in the financial crisis: The sustainable implications for SMEs

Huan Huu Nguyen¹, Thanh Phuc Nguyen^{2*} and Thi Xuan Huong Tram¹

Abstract: Despite the driving role of economic growth, SMEs in Vietnam have dealt with many critical constraints relating to insufficiency of internal financing sources and inaccessibility of external funds arising from the crisis period. Based on the unique dataset of Vietnam's SMEs covering the period of 2008–2016, this research aims to investigate the role of the financial crisis on financing and investment behaviours of SMEs, which remains scarce in the existing studies. The results find that there is a reduction in SMEs' investment caused by the crisis period. In addition, following the onset of the economic crisis, the internally generated finance is more influential on SMEs' investment than the supply of bank finance, supporting the pecking order theory to explain the nexus between investment and financing behaviours, similar to the behaviours of large-sized firms or listed firms. Some policy implications are provided to better conduct business practices for the sustainability of SMEs.

Keywords: Financial crisis; investment; financing behaviours; SMEs

Subjects: C53; E37; L21; L52

1. Introduction

SMEs are considered as the critical drivers for the economic development of emerging countries (Harvie & Lee, 2002). However, SMEs have experienced many financial constraints in enhancing the capital structure and the limited accessibility to financing capital with hope for capturing the

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PUBLIC INTEREST STATEMENT

Small and medium-sized enterprises (SMEs) are viewed as development engines for emerging countries, but these firms face difficulties in accessing funding sources to take advantage of growth opportunities, especially in the context of the financial crisis. This study highlights the role of the 2008–2010 financial crisis in the investment and financing of SMEs in Vietnam. The results show that the decline in investment occurred during the 2008–2010 financial crisis. Moreover, in this uncertain period, SMEs have to depend on internal funding sources rather than bank loans. This result provides the necessary policy suggestions to help SMEs easily access external capital sources during the crisis period so that they can take advantage of the flexibility in operating capacity, thereby fulfilling their driving role in stimulating economic growth.

growth opportunities. Accordingly, insufficient internal capital mainly comes from the capital of friends and family. It is difficult for SMEs to gain access to the external capital (e.g., the credit supply from banks) or issue shares, partly because of low profitability and asymmetric information related to the lender-borrower relationship (Trinh et al., 2017). Given these issues faced with SMEs, the awareness of the important role of SMEs and the in-depth research on SMEs' behaviour through funding and investment-related issues has recently been a central concern of the growing studies.

The 2008–2010 financial crisis has considerably changed the investment and financing decisions of SMEs to a greater extent. Accordingly, the global financial crisis has observed the rate reduction in SMEs' development, and thus hampering the overall economy due to the driving role of SMEs in the recovery of the economic environment (Man & Macris, 2014). The economic crisis raised certain barriers and costs for SMEs to access financial sources relative to large firms listed on the stock exchange (De la Torre et al., 2008). The 2008–2010 financial turmoil could amplify the weaknesses of SMEs' internal characteristics such as difficulty in accessing the stock market, large information asymmetry, a high level of bankruptcy, and few opportunities for SMEs' owners and directors to diversify for the sake of personal wealth, fewer collateral sources when borrowing (Beck et al., 2008; Danielson & Scott, 2007; López-Gracia & Mestre-Barberá, 2011; Michaelas et al., 1999).

This research aims to investigate the changes in Vietnamese SMEs' investment decisions when the 2008–2010 financial crisis is underway. Furthermore, the preference among financing sources such as internal and external finance are examined to discover the choice of suitable sources to finance SMEs' operating activities under a time of financial crisis. For the former objective, the Q-theory could be applied to explain the changes in SMEs' investment behaviours. For more details, this theory implies that the presence of growth chances could cause firms to make investments (Rousseau & Kim, 2008). Following the asymmetric theory of investment, the financial market imperfections induce firms to confront financing constraints and hence lead changes in investments (Kasahara, 2008). The reduction in investment from implications of both theories is attributed to a decrease in growth opportunities caused by the financial crisis.

For the latter, adverse selection and moral hazard theories argue that internal finance is relatively cheaper than external finance for enterprises with unclear prospects and inefficient capital markets (Wang, 2010; Yang et al., 2009). According to the theory of pecking order, a given firm first prefers internally produced finance, then debt, and ultimately equity (Agliardi et al., 2016). Firms prefer internal financing sources over external financing ones due to expenses associated with asymmetric information, agency issues, and control limits between owners and management. If external funding is necessary, debt is favored. In addition, Fazzari et al. (1987) suggest that the increased cost of achieving external financing sources could be attributed to an increase in information asymmetry. Bigelli et al. (2014) contend that private enterprises have greater debt ratios and a higher share of short-term debt than large peers. During a financial crisis, these enterprises experience increasing financial limitations due to difficulty accessing other sources of capital (Akiyoshi & Kobayashi, 2010).

Since the Law on Enterprises was enacted in 1999 and came into effect in 2000, the number of SMEs has increased rapidly. Clause 3, Decree No. 56/2009/ND-CP on "Support and development of SMEs" notes that SMEs are defined as business entities registered under the law and classified into three levels of micro, small and medium according to capital size and a number of employees (Trinh et al., 2017). SMEs in Vietnam are acknowledged as a crucial driving force for the economy, contributing significantly to solving social-economic issues (Archer, 2021; Nguyen et al., 2016). Reported in 2018 by the Asian Development Bank (ADB), SMEs account for the majority (approximately 97.6%) of the total 600,000 businesses operating in Vietnam, contributing up to 40% of GDP and more than 50% of jobs. Thus, SMEs could positively drive the GDP growth, create jobs, produce a variety of goods for society, improve the social resources for investment, reduce poverty and develop networks with other key areas. However, SMEs might be more vulnerable than other economic agents due to the fact that

81,000 SMEs out of 91,000 ones go bankrupt in the first 5 months of 2021, as reported by the Ministry of Planning and Investment of Vietnam. Overall, H. H. Nguyen et al. (2021) show that 54.5% of SMEs are not well prepared for an event such as a crisis, which is the main cause of unexpected difficulties during the crisis. One should note that the research on the impact of the crisis, especially the previous period of 2008–2010, on the SMEs could draw some profound implications for the recent and future crisis with the identical characteristics.

Empirical studies on SMEs in Vietnam mainly focus on a number of perspectives that are relevant to financial decisions, the nature of financial sources and SMEs' access to capital financing through firm characteristics (such as the attributes of social relations, forms of business professionalisation) and characteristics of the business owner (such as the owner's education, psychology, and attitude). Specifically, Nguyen and Luu (2013) studied SMEs in the manufacturing sector of Vietnam to investigate financial decisions for new investment projects and funding behaviour. Among SMEs, small enterprises face many limitations compared to medium-sized enterprises. In addition, formal or social relationships affect an enterprise's ability to access capital. Surprisingly, enterprises in big cities tend to use as much informal capital from individual lenders, friends, or families. N. Nguyen et al. (2015a) studied data collected from a survey of 487 SMEs in Hanoi (June, 2013), showing that the characteristics of business owners, gender, and education level are highly considered as the factors that most strongly affect enterprises' ability to access capital, directly shaping SMEs' relationships with banks and customers. Based on the SMEs' survey in the period of 2007–2013, Archer (2021) argues that forms of professionalisation such as business registration certificates, corporate tax code certificates, and seal-owned certificates could influence the financial decisions of the business, increasing the use of debt, equity and retained earnings. Through data of 263 questionnaire surveys conducted in Ho Chi Minh City (from June to August 2013), Hoang and Otake (2014) find that owner's personal characteristics in relation to behavioural financial factors such as risk attitudes to debt financing, overconfidence, and the social relationship could affect the SMEs' ability to participate in financing activities and choose credit sources. This study could explain the phenomenon of the use of informal credit sources in developing countries.

Taken together, these studies have not addressed the impact of the financial crisis on investment and the impact of financing sources on SMEs' investments in the context of the increased uncertainty and risk caused by the macro-financial crisis. In addition, scarce studies have distinguished internal or external sources of financing in quantitative models, so it is ambiguous which sources of capital financing are significantly vital to SMEs during the crisis. Therefore, this study could fill these research gaps, combined with various panel regression approaches to make new contributions more robust.

The main added value of this paper is as follows: First, SMEs frequently utilize both sources of financing capital such as internally generated finance and bank loan supply (Becchetti et al., 2010). However, the lack of internal financing and limited ability to access bank credit supply could pose severe constraints on investment and business activities (Trinh et al., 2017). One should note that SMEs turn to use internal funds to finance new investment opportunities as commercial banks have to tighten their loans, causing negative impacts on SMEs' investment behaviour during the crisis. These are appropriate to the context of Vietnamese SMEs, which is evidently confirmed in current research. For more details, Vietnamese SMEs face a reduction of investment in the 2008–2010 crisis period. Furthermore, SMEs become dependent on internal finance rather than bank loan supply under this crisis. To the best of our understanding, the current study is among the first to investigate the context of Vietnam, showing the reduction in investment of SMEs and its preference of internally generated finance over the bank loan supply during the crisis period.

Second, most of the empirical studies on the fundamental perspectives on investment and financing behaviours are primarily pronounced on publicly listed firms (Duchin et al., 2010). In addition, these concepts are widely discussed in either developed markets like the United States (Nguyen et al., 2015b) or a developing country like China (Bo et al., 2014). For the case of emerging markets, SMEs are seen as an important engine in economic growth (Trinh et al., 2017), which remains scarce, especially in a time of financial crisis. This period could amplify SMEs' difficulties in

investment in response to new investment opportunities as well as possibly causing changes in financing behaviours. Although SMEs play an important role in several characteristics such as business start-ups, innovation, labor, and potential growth (Ayyagari et al., 2007; Kirchhoff et al., 2007; Lee et al., 2010), research on investment and financing behaviours of SMEs in an emerging market could be rather promising to study. Therefore, this study needs to be conducted to evaluate the impact of the crisis on SME financing behaviour in emerging markets such as Vietnam.

Third, the database for SMEs is insufficient compared to listed firms, especially in the Vietnamese context—the data has been drawn on surveys with missing data related to financial figures. This limits research papers on the topic of investment and financing behaviours by SMEs. To be specific, Trinh et al. (2017) discuss the impact of capital structure on the decision to seek new investment opportunities and choice of financing sources. However, the work of Trinh et al. (2017) has employed data available with a 2-year consecutive gap (e.g., 2005, 2007, and 2009). Investment data are not available, inducing previous studies to limit the use of dummy variables for investment proxies together with the logit regression treatment. In our research, we employ the comprehensively updated data provided by the General Statistics Office of Vietnam rather than Central Institute for Economic Management of the Ministry of Planning and Investment employed by prior studies on Vietnamese SMEs. Hence, the sufficient disclosure of SMEs' data related to financial figures on balance sheets allows us to test the investment and financing behaviours of SMEs by using the conventional regression treatment such as fixed-effect model, two-stage least square, and panel quantile regression.

The remainder of research is structured as follows: Section 2 shows the literature and development of respective hypotheses. In Section 3, the methodology and data are provided. Section 4 illustrates the research findings, robustness test, and further investigation. Section 5 presents the conclusion and several key policy suggestions for the development of SMEs in Vietnam.

2. Hypotheses development

2.1. Financial crisis and investment behaviours

Firms make investments when there is a chance for significant growth (Rousseau & Kim, 2008). According to the asymmetry theory of investment, the inefficiencies of the financial market cause enterprises to experience differing degrees of financing restrictions and, as a result, undertake unequal levels of investment (Kasahara, 2008). Since a financial crisis is linked with fewer chances for expansion and greater financial limitations, both theories anticipate a drop in investment during a financial turmoil period. According to Kahle and Stulz (2013), during a crisis, bank supply, credit supply, and demand shocks cause significant uncertainty and push enterprises to cut capital expenditure for investment. We anticipate that all of these effects will be more significant for private enterprises than for public counterparts.

Many empirical studies have addressed the negative effects of the crisis period on the macroeconomic variables and the economy. For example, Rousseau and Kim (2008) and Kim et al. (2002) studied the financial crisis in Korea and observed the contraction of the credit market. The negative impact of this contraction was also noted by Akiyoshi and Kobayashi (2010) for Japan. Chen and Hsu (2005) found that SMEs experienced a stronger decline in output than large firms during the Asian financial crisis. Since the financial crisis began in 2008, commercial banks have continuously tightened credit supplies, imposing additional financial constraints on private enterprises. Financial constraints during a period of crisis will worsen and can have a critically negative impact on corporate investments (Zubair et al., 2020).

In the context of the recent financial crisis, Ogawa and Tanaka (2013) analysed data of Japanese SMEs and identified many shocks related to supply, demand, and corporate finance affecting the investment behaviours of SMEs. In terms of investment influences, Duchin et al. (2010) and Kahle and Stulz (2013) observed that the credit crisis had a negative impact on listed companies in the US. Akbar et al. (2013) and Vermoesen et al. (2013) have similar results when studying at private

firms in the UK and Belgium. In general, the shocks arising from the financial crisis will cause a decrease in the investment of private enterprises. Even if there are still chances for operating expansion, SMEs may be hesitant to make new investments owing to greater uncertainty and a shortage of finance. Therefore, the first research hypothesis is proposed as follows:

H1: The financial crisis has a negative impact on SMEs' investment.

2.2. The impact of financial crisis on the financing-investment relation

Evaluation and selection of firms for internal or external capital sources are considered according to their costs and benefits. Existing theoretical models of adverse selection and moral hazard have supported the usage of internal capital rather than external funding for firms facing uncertain prospects and operating in the imperfect market (Yang et al., 2009). Although the fundamental theories of large firms' financial decisions could be applied to private firms, Du et al. (2015) have acknowledged the financial decisions as to the most challenging problems for SMEs. According to pecking order theory, a firm will have the following financing order: first retained earnings, followed by debt, and finally equity for the last resort (Agliardi et al., 2016). This theory states that, because of the costs incurred due to information asymmetry, agency problems, and limited control between managers and owners, firms will tend to prefer using internal financing sources rather than external ones. In case of the strict requirements of external capital usage, debt will be given priority over equity. Many studies (Degryse et al., 2012; Gregory et al., 2005; Sogorb-Mira, 2005) have considered the capital-related financing classification from the perspective of order theory.

Financing decisions are closely correlated with investment decisions. Market imperfections often lead to mutual interactions between these two decisions. Fazzari et al. (1987) are among the first to address the impact of imperfect markets on investment. The author argues that an increase in the information asymmetry causes an increase in the cost of using external financing sources (e.g., issuing new debt or new equity). Therefore, firms will have more incentives to use internal financing (e.g., retained earning) for investment. Since internal capital is insufficient, firms need to use external sources to finance new investment activities. Therefore, a SMEs' investment will rely heavily on financial sources generated within the internal enterprise.

SMEs are particularly dependent on bank loans, which are the main external funding source for their business operations (Berger & Udell, 1998; Petersen & Rajan, 1994). A marginal change in the bank credit supply will have a very strong impact on firms' investment. Bigelli et al. (2014) argued that private firms are characterised by a high ratio of total debt and short-term debt relative to large firms. When the financial crisis occurs, these firms could experience difficulties in accessing financing due to their high debt level (Akiyoshi & Kobayashi, 2010). Therefore, internally generated capital becomes an important source of capital for SMEs in the crisis period. Accordingly, these firms will mainly depend on internal capital to finance their investment activities. However, Zubair et al. (2020) examine the sample of 469 SMEs in the Netherlands, suggesting that in times of increasing crisis, SMEs could face uncertainty in investment projects. Consequently, these SMEs are unwilling to take risks to their internal capital. This undesirable behaviour is likely that SMEs often have small governance structures and centralised management of assets and income on the few who have executive power (Zubair et al., 2020). Moreover, it is interesting that SMEs will not depend much on internal sources of capital compared to external sources (e.g., bank loan supply). In other words, in the face of an increasing crisis, managers of SMEs are not willing to use the funding for investment projects unless they are backed by external lenders. From the perspectives of theoretical fundamentals and empirical evidence, the second research hypothesis is stated as follows:

H2: During the crisis, SMEs' investment becomes more reliant on internal financing sources rather than external ones.

3. Methodology

3.1. Model specification

The proxies for SMEs' investment are regressed on the explanatory variables, including cash flow, profitability, scale, and growth opportunity (Badertscher et al., 2013; Yang et al., 2009). The fixed effects regression model is used as follows:

$$\begin{aligned} \text{Investment}_{it} = & \alpha + \beta_1 \text{Crisis} + \beta_2 \text{Cashflow}_{it} + \beta_3 \text{Profitability}_{it} + \beta_4 \text{Size}_{it} + \beta_5 \text{Growth}_{it} \\ & + \beta_6 \text{Firm}_i + \varepsilon_{it} \end{aligned} \quad (1)$$

where CRISIS is a dummy variable with the value of 1 for the crisis period 2008–2010 and 0 otherwise. Investment_{it} , Cashflow_{it} , $\text{Profitability}_{it}$, Size_{it} , and Growth_{it} are investment-total assets ratio, the cash flow over total assets ratio, the natural logarithm of total assets, the ratio of gross profit to total revenue, the revenue growth rate of firms i in year t , respectively. Firm_i control for firm-specific fixed effects. ε_{it} is an error term. Specifically, the investment variable is measured by 04 sub-variables, including the annual rate of change in fixed assets and depreciation over total assets at the beginning of the year, the annual increase rate of fixed assets and depreciation over the total assets at the beginning of the year, the ratio of the annual rate of change of tangible fixed assets and depreciation to total assets at the beginning of the year, the ratio of the annual rate of increase of tangible fixed assets and depreciation to total assets the begin of the year. Cashflow_{it} , $\text{Profitability}_{it}$, Size_{it} , and Growth_{it} are frequently used as control proxies to potentially explain investment (Duchin et al., 2010; Honjo & Harada, 2006; Rahaman, 2011). Accordingly, Cashflow_{it} is the ratio of total operating profit and depreciation to total assets at the beginning of the year, $\text{Profitability}_{it}$ is the gross profit divided by total revenue, Size_{it} is the natural logarithm of total assets and Growth_{it} is the growth rate of total revenue. In reality, banks will often provide credit to large-scale firms with rich cash flow and high revenue growth, thereby affecting the firms' capital raised for investment opportunities. All the research variables are described in Table 1.

Model (1) for hypothesis H1 testing examines how SMEs' investment behaviour will change during the period of the global financial crisis in 2008–2010. The expected sign of β_1 is negative, implying that SMEs' investment will decline during a period of the financial crisis. In other words, economic and financial conditions have a negative impact on the investment behaviour of SMEs. Consequently, SMEs could change their investment behaviour to adapt to the business environment during and after the crisis.

To test hypothesis H2 for firms' preference of external financing sources or external ones in the context of the global financial crisis in 2008–2010. Model (2) with the inclusion of interaction terms into Model (1) is employed as follows:

$$\begin{aligned} \text{Investment}_{it} = & \alpha + \beta_1 \text{Crisis} + \beta_2 \text{InternalFinance}_{it} + \beta_3 \text{ExternalFinance}_{it} + \\ & \beta_4 \text{InternalFinance}_{it} * \text{Crisis} + \beta_5 \text{ExternalFinance}_{it} * \text{Crisis} + \beta_6 \text{Profitability}_{it} + \\ & \beta_7 \text{Size}_{it} + \beta_8 \text{Growth}_{it} + \text{Firm}_i + \varepsilon_{it} \end{aligned} \quad (2)$$

In addition to using the interaction term between CRISIS dummy variable and two proxies for internal financing (Internal_{it} , the sum of income after tax and depreciation over the total assets at the beginning of the year) and external financing (External_{it} , the change in bank loan supply over the total assets at the beginning of the year). The interaction variables of internal finance and external finance with crisis period are included such as $\text{InternalFinance} * \text{Crisis}$ and $\text{ExternalFinance} * \text{Crisis}$, respectively. For the purpose of brevity, we use the term InCri and ExCri to stand for $\text{InternalFinance} * \text{Crisis}$ and $\text{ExternalFinance} * \text{Crisis}$, respectively, onwards.

Panel data together with a long analytical timeframe and the fixed-effects regression method are applied to both models. This practice is to control the unobserved characteristics of each firm without fluctuating over time (Bastos & Pindado, 2013). To determine the best estimation method,

Table 1. Summary for all research variables and its definition

| Variables | Definition |
|------------------------------|--|
| Dependent Variable | |
| Tot_fixassets | The annual rate of change in fixed assets and depreciation over total assets at the beginning of the year (employed for the baseline regression model) |
| Tang_fixassets | The ratio of the annual rate of change of tangible fixed assets and depreciation to total assets at the beginning of the year (employed for the robustness test) |
| Independent Variable | |
| Cashflow | The ratio of total operating profit and depreciation to total assets at the beginning of the year |
| Profitability | The ratio of gross profit to total revenue at the beginning of the year |
| Size | The natural logarithm of total assets at the beginning of the year |
| Growth | The growth rate of total revenue at the beginning of the year |
| InternalFinance | The sum of income after tax and depreciation over the total assets at the beginning of the year |
| ExternalFinance | The change in bank loan supply over the total assets at the beginning of the year |
| Interactive variables | |
| InCri | The product of InternalFinance and the dummy variable accounting for the financial crisis |
| ExCri | The product of ExternalFinance and the dummy variable accounting for the financial crisis |
| Dummy Variable | |
| Crisis | A dummy variable with the value of 1 for the crisis period of 2008–2010, and 0 otherwise |

Source: Author's summary from prior research

Breusch and Pagan statistical test is used to choose between the random effects regression model and the classical ordinary least square regression model. Moreover, the Hausman test is employed to choose between the fixed effects regression model and the random effects regression model. The expected result is that a fixed effects regression model will be selected and this is in line with previous studies using fixed effects regression in investigating the SMEs' investment behaviour (Akbar et al., 2013; Vermoesen et al., 2013). In addition to the robustness of regression results, the two-stage least square regression (2SLS) method and the generalised method of moments (GMM) method with instrument variables are utilised to overcome the possible endogenous problems. We additionally test the value distribution of investment employing quantile regression to provide further understandings related to the investment and crisis nexus, which is more contributing to the literature on the crisis impact on investment and the investment behaviours driven by the financing sources when considering the quantile distribution of investment values.

3.2. Research data

The database for this research is the unbalanced panel data of Vietnamese SMEs from 2008 to 2016. This period is based on the data availability provided by the General Statistics Office of Vietnam (GSO). One should note that the sub-period of 2008–2010 in this research was set as a milestone for the global financial crisis (Man & Macris, 2014). The panel data allows capturing all time-invariant firm-specific features by using the firm fixed effects (Bastos & Pindado, 2013). Criteria to define small and medium enterprises are based on Decree 39/2018/ND-CP for the agriculture, forestry, fisheries, and industry and construction sectors, as summarised in Table 2.

Table 2. The classification of SMEs in Vietnam

| Categories | The average number of labor participating in Social Insurance Scheme | Revenue | Capital |
|---|--|--|--|
| The agriculture, forestry, fisheries and industry and construction sectors | | | |
| Micro enterprises | Not more than 10 head counts | Not more than 3 billion Vietnam Dong | Not more than 3 billion Vietnam Dong |
| Small enterprises | Not more than 100 head counts | Not more than 50 billion Vietnam Dong | Not more than 20 billion Vietnam Dong |
| Medium enterprises | Not more than 200 head counts | Not more than 200 billion Vietnam Dong | Not more than 100 billion Vietnam Dong |
| Trade and service industry | | | |
| Micro enterprises | Not more than 10 head counts | Not more than 10 billion Vietnam Dong | Not more than 3 billion Vietnam Dong |
| Small enterprises | Not more than 50 head counts | Not more than 100 billion Vietnam Dong | Not more than 50 billion Vietnam Dong |
| Medium enterprises | Not more than 100 head counts | Not more than 300 billion Vietnam Dong | Not more than 100 billion Vietnam Dong |

Source: Decree 39/2018/NĐ-CP on criteria to classify SMEs

The dataset for all financial items of SMEs is gathered from GSO with the initial data of over 500,000 firms. Although only capturing the SMEs' data of Ho Chi Minh city and several surrounding provinces, this continuously unique dataset is more beneficial than the survey data collected every 2 years, which is primarily used in the context of Vietnam's SMEs (Trinh et al., 2017), in employing the conventional regression estimation.

In addition, the study also uses a number of criteria to obtain the appropriate data as follows: (i) Remove firms operating in the financial sector (e.g., banking, insurance, investment institutions), not-for-profit sectors, and government-related sectors as non-business considerations of these businesses affect its financial decisions; (ii) Firms with double total assets in one year or firms with negative equity are also excluded from the sample because of the high possibility that these firms could participate in consolidation and merger or large-scale restructuring; and (iii) Eliminate 1% of observations in the sample to avoid the effect of outliers. In addition, we winsorise at the 1% level of both tails of observation to avoid the impact of outliers. After processing the raw data relating to financial information of SMEs with the aforementioned filtering requirements, the final dataset includes 65,535 firm-year observations.

3.3. Estimation method

In this study, we employ the standard fixed-effects model, which is in line with the approach of Vermoesen et al. (2013) and Akbar et al. (2013) investigating the behaviour of SMEs' investment. The Breusch and Pagan test is used to choose the suitable estimator between ordinary least squares regression and random-effect estimator. In addition, the preference of the fixed-effect estimator over the random-effect estimator could be tested by utilising the Hausman test. In this study, the fixed-effect estimation shows the most appropriate technique over others due to rejecting the null hypotheses in the Hausman test, which is used consistently across all specifications. Furthermore, to address the potential endogenous, the two-stage least square (2SLS) estimation is used to ensure robust results based upon the least square estimation approach. Therefore, FEM and 2SLS estimation are shown in all tables of regression results. Moreover, we broaden the literature by dissecting the investment behaviours of SMEs at the distribution tails of investment value affected by the crisis and alternative financing funds, which is obtained by the quantile estimation regression. This approach gives us more details of interpretation in the nexus of investment—financial crisis and investment—financing sources varying with the dispersion of investment levels.

Table 3. Descriptive statistics

| Variable | Mean | Standard Deviation | Min | Max |
|-----------------|--------|--------------------|--------|-------|
| Tot_fixassets | -0.013 | 0.114 | -0.399 | 0.424 |
| Tang_fixassets | -0.013 | 0.112 | -0.389 | 0.419 |
| InternalFinance | -0.063 | 0.132 | -0.647 | 0.265 |
| ExternalFinance | 0.462 | 0.319 | 0.000 | 0.979 |
| Cashflow | -0.059 | 0.136 | -0.647 | 0.311 |
| Profitability | -0.092 | 0.427 | -3.196 | 0.359 |
| Growth | 0.083 | 0.398 | -1.218 | 1.475 |
| Size | 22.35 | 1.377 | 19.16 | 25.85 |

4. Empirical results and discussion

4.1. Descriptive statistics and pairwise correlations

In Table 3, the mean value of internal finance is -6.3%, ranging from a minimum value of -64.7% to a maximum value of 26.5% while that of external finance is 46.2%, ranging from a minimum value of 0% to a maximum value of 97.9%. This suggests that on average, SMEs in Vietnam are more possibly reliant on bank financing than internal financing due to the inefficiency of business operation, which could not generate sufficient financial sources for the demand of SMEs.

In Table 4, the change in total fixed assets is highly associated with the change in the tangible fixed assets (correlation = 0.955), leading to including them into separate specifications to avoid spurious regression. Table 2 also reports the low correlation between internal finance and external finance (correlation = 0.027). The cash flow has the same calculation as internal finance, thus the correlation between them naturally reaches a nearly perfect correlation with internal finance (correlation = 0.996). Therefore, two variables do not enter into the same specification. Interestingly, the profitability and growth show a negative correlation with the investment in total fixed assets and tangible fixed assets meanwhile, size and cash flow have a positive association with the investment in total fixed and tangible fixed assets. As a whole, the independent variables all show a low correlation with each other, indicating no existence of multicollinearity issues. This is supported by the VIF of each variable in Table 4 under the threshold value of 10 (Gujarati et al., 2012), showing no concern of multicollinearity in our research.

4.2. Main findings

We first investigate the changes in investment behaviours of SMEs during the crisis period. Table 5 illustrates the empirical results. Following Zubair et al. (2020), we employ the approach of the nested stepwise regression in which the controlled variables are excluded one by one from the full specification in order to compare possible changes in the regression coefficients in the models. As compared to Models (1)-(3), Model (4) is extended to cover sufficiently examined variables. The significant value of F-statistics at the 1% significance level at the bottom line of each table shows the models' appropriateness in explaining fluctuations of investment by dependent variables. The adjusted R² of regressions is slightly smaller than the R² in the works of Zubair et al. (2020), Akbar et al. (2013), and Vermoesen et al. (2013).

Overall, the results show the investment reduction caused by the 2008–2010 financial crisis, which is robust across all models. For the econometric magnitude of Model (4), the investment in total fixed assets decreases by 1.55 percentage points due to the bad consequences of the financial crisis. Therefore, we can conclude that SMEs' investments in Vietnam are influenced by the financial crisis, clearly supporting Hypothesis 1. This finding is consistent with Vermoesen et al.

Table 4. Pairwise correlations

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | VIF |
|---------------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|
| (1) Tot_fixassets | 1 | | | | | | | | 1.21 |
| (2) Tang_fixassets | 0.955 | 1 | | | | | | | 1.21 |
| (3) InternalFinance | 0.163 | 0.164 | 1 | | | | | | 1.14 |
| (4) ExternalFinance | -0.013 | -0.011 | 0.027 | 1 | | | | | 1.12 |
| (5) Cashflow | 0.159 | 0.160 | 0.996 | 0.021 | 1 | | | | 1.19 |
| (6) Profitability | -0.007 | -0.007 | 0.346 | 0.122 | 0.350 | 1 | | | 1.14 |
| (7) Size | 0.010 | 0.014 | 0.187 | 0.445 | 0.183 | 0.134 | 1 | | 1.11 |
| (8) Growth | -0.021 | -0.018 | 0.139 | 0.045 | 0.142 | 0.270 | 0.034 | 1 | 1.19 |

(2013) investigating SMEs in Belgium and Akbar et al. (2013) examining UK's private firms. For theoretical justifications, firms with growth opportunities could increase investment given the Q-theory explanation (Rousseau & Kim, 2008). However, as noted by the asymmetry theory of investment, the imperfections in the financial markets possibly caused by the financial crisis period could induce SMEs to confront various levels of financing restrictions and therefore conduct the respective investments (Kasahara, 2008). These lead to a fall in investment (Kahle & Stulz, 2013).

Concerning the control variables, the cash flow has a statistically positive coefficient with the investment, suggesting the enhancing role of cash flow in improving the SMEs' investment in Vietnam. However, the investment is negatively affected by profitability, scale, and growth, indicating that small-sized, less profitable, and lower growth private firms could undertake more investment.

The main result of the negative impact of the financial crisis on investment and other explanatory variables using the 2SLS method is quite similar to the findings using the FEM method, except the change in coefficients of cash flow-investment nexus from positive to negative association after addressing the potential endogeneity by instrument variables of 2SLS approach. The testing values of F-statistics at the bottom line of each table are statistically significant at 1% level, showing the validity of the chosen instrument captured in 2SLS regression estimates. However, for the next regression including more variables into the baseline model, the coefficients remain consistent across all the specifications, leading us to make inferences from the negative results.

We continue processing the regression with the inclusion of interaction terms between financing sources and a dummy variable accounting for the financial crisis to test Hypothesis 2, answering the question of whether the investment in the crisis period could be influenced by external or internal financing. Due to the highly pairwise correlations between the internal finance and the cash flow reported from Table 4, we exclude the cash flow to avoid spurious regression due to high association among independent variables, which is in line with the approach of Zubair et al. (2020).

The nested stepwise regressions in Table 6 shows statistically positive impacts of internal finance on investment across all models and report no nexus between external financing and investment, suggesting the critical dependence of SMEs on financing internally rather than externally. These findings are not coherent with the study of Zubair et al. (2020) in the context of the Netherlands' SMEs. At the same time, these empirical results are in line with the arguments of Akiyoshi and Kobayashi (2010), showing the less dependence of SMEs on internal financing than external financing, supporting Hypothesis 2. This could be attributed to the pecking order theory in case of imperfect financial markets. For more details, due to asymmetric information, agency issues, and control constraints between owners and managers, SMEs could prefer internal financing sources to external financing ones (Agliardi et al., 2016). In a time of financial crisis, these firms are confronted with a high degree of financial frictions due to increased uncertainty in exposure to alternative financing sources (Akiyoshi & Kobayashi, 2010).

The interaction terms of internal finance and investment are significantly positive, indicating the increase in investment during the financial crisis when Vietnam's SMEs obtain more internal financing than external financing. In the other words, SMEs are normally much more reliant on bank financing for their investment demand in firms' operation (Berger & Udell, 1998), but in the case of uncertainty arising from the crisis, the investment of SMEs increases only when there are financial sources generated from internal firms. This is because with specific features such as a lower collateral asset base and limited access to the external capital market, Vietnam's SMEs are frequently characterised by financial fragility and the crisis could impose more constraints on private firms. Additionally, the cost of gaining access to external finance could be increased due to a high level of asymmetric information (Fazzari et al., 1987). It gives a rise for SMEs to use internal

Table 5. Impact of the global financial crisis on investment with the use of Tol_Fixassets as dependent variable

| | Fixed-Effect estimation method | | | | Two-stage least square estimation method | | | |
|-----------------------------|--------------------------------|------------------------|------------------------|-----------------------|--|------------------------|-----------------------|----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Crisis | -0.008*** [-5.49] | -0.008*** [-5.48] | -0.0164*** [-10.48] | -0.016*** [-9.89] | 0.0699*** [9.88] | 0.0793*** [10.32] | 0.079*** [9.95] | 0.073*** [9.40] |
| Cashflow | 0.215*** [34.91] | 0.248*** [38.08] | 0.261*** [39.87] | 0.264*** [40.15] | -0.0088*** [-5.23] | -0.0085*** [-5.07] | -0.008*** [-5.00] | -0.008*** [-4.72] |
| Profitability | -0.031*** [-15.21] | -0.0299*** [-14.82] | -0.027*** [-12.80] | -0.027*** [-12.80] | -0.0107*** [-6.60] | -0.011*** [-6.66] | -0.007*** [-6.66] | -0.007*** [-4.21] |
| Size | | -0.021*** [-15.11] | -0.021*** [-15.00] | -0.021*** [-15.00] | | 0.0003 [0.81] | 0.0005 [1.20] | |
| Growth | | | -0.0078*** [-4.75] | -0.0078*** [-4.75] | | | | -0.012*** [-6.59] |
| Constant | 0.0002 [1.52] | 0.475*** [0.28] | 0.472*** [15.12] | 0.472*** [15.03] | -0.0118*** [-15.61] | -0.0120*** [-16.16] | -0.0198*** [-2.06] | -0.023*** [-2.43] |
| Adjusted R ² | 0.0248 609.69 | 0.0292 485.83 | 0.0133 423.49 | 0.0142 343.47 | 0.0295 60.06 | 0.0338 43.82 | 0.0334 34.13 | 0.0330 32.00 |
| F-statistic | | | | | 0.000 0.000 | 0.000 0.000 | 0.000 0.000 | 0.000 0.000 |
| P-value (F-Statistic) | | | | | | | | |
| F-statistic (Instrument) | | | | | 290.39 | 299.86 | 295.35 | 348.03 |
| P-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: The table shows the results of fixed-effects and two-stage-least-square estimation. The dependent variable, Tol_fixassets regresses on the dummy variable capturing the global financial crisis and other control variables including cash flow, profitability, size, and growth. All variable definitions are reported in Table 1. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively. Standard errors are in brackets.

Source: Author's calculation

Table 6. Impact of the global financial crisis on investment depending on the financing sources with the use of Tol_fixassets as dependent variable

| | Fixed-Effect estimation method | | | | | | | Two-stage least square estimation method | |
|--------------------------|--------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------------------|--|--|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | |
| Crisis | -0.010*** [-4.71] | -0.009*** [-4.28] | -0.020*** [-4.38] | -0.019*** [-4.29] | -0.008** [-2.50] | -0.0075** [-2.38] | -0.00733*** [-2.33] | -0.0074*** [-2.37] | |
| InternalFinance | 0.324*** [36.44] | 0.364*** [39.02] | 0.379*** [40.49] | 0.382*** [40.77] | 0.0159* [1.88] | 0.0199*** [2.28] | 0.0194*** [2.17] | 0.0205*** [2.29] | |
| ExternalFinance | 0.0160*** [3.17] | 0.0166*** [3.28] | 0.0268*** [5.29] | 0.0257*** [5.09] | 0.00293 [1.57] | 0.00378** [2.03] | 0.00333 [1.64] | 0.0028 [1.37] | |
| InCri | 0.0923*** [6.18] | 0.0843*** [5.66] | 0.111*** [7.84] | 0.106*** [7.48] | 0.140*** [14.03] | 0.140*** [14.10] | 0.140*** [14.11] | 0.137*** [13.71] | |
| ExCri | 0.00167 [0.39] | 0.00115 [0.27] | 0.0118 [1.57] | 0.0126* [1.67] | 0.0086 [1.62] | 0.00823 [1.55] | 0.00808 [1.52] | 0.0087 [1.64] | |
| Profitability | -0.0375*** [-13.60] | -0.037*** [-13.42] | -0.037*** [-11.00] | -0.032*** [-11.00] | -0.032*** [-11.00] | -0.006*** [-3.62] | -0.006*** [-3.63] | -0.0036*** [-2.12] | |
| Size | | -0.029*** [-14.10] | -0.029*** [-13.79] | -0.029*** [-13.79] | | | 0.00025 [0.54] | 0.00036 [0.76] | |
| Growth | | | -0.013*** [-5.04] | -0.013*** [-5.04] | | | | -0.009*** [-4.95] | |
| Constant | 0.00127 [0.48] | 0.000599 [0.23] | 0.659*** [14.05] | 0.646*** [13.77] | -0.016*** [-12.51] | -0.016*** [-13.37] | -0.0217*** [-2.09] | -0.0234*** [-2.26] | |
| Adjusted R ² | 0.0532 | 0.0602 | 0.0315 | 0.0333 | 0.0156 | 0.0177 | 0.0175 | 0.0186 | |
| F-statistic | 286.65 | 271.75 | 261.71 | 232.43 | 65.54 | 56.36 | 48.41 | 45.26 | |
| P-value (F-Statistic) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | |
| F-statistic (Instrument) | | | | | 477.77 | 557.39 | 549.74 | 551.71 | |
| P-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 | |

The table shows the results of fixed-effects and two-stage-least-squares estimation. The dependent variable, Tol_fixassets regresses on internal financing, external financing, the interaction terms between two leading financing sources and the dummy variable capturing the global financial crisis, and other control variables including cash flow, profitability, size, and growth. All variable definitions are reported in Table 1. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively. Standard errors are in brackets.

Source: Author's calculation

sources of financing for a firm's activities. Hence, the investment of SMEs is more dependent on internal finance than external finance, especially in the aftermath of the financial crisis.

For explanatory variables, we observe the negative linkages between growth and profitability on investment, suggesting the fact that SMEs with well-profitability and better growth rate of revenue have a lower investment in total fixed assets. These findings are contrary to previous studies such as Serrasqueiro et al. (2012) and Zubair et al. (2020), which argue the stimulating role of SMEs' growth and profitability on the investment. These controversies might be explained by the notion that the high level of growth and profitability do not imply the real financial funds to increase the investment of SMEs in Vietnam. Such firms could accumulate profit-generated sources due to precautionary purposes.

Table 6 also reports the results of testing Hypothesis 2 using the 2SLS method to account for the potential endogeneity bias, the findings are quite similar to the models with FEM regression. Moreover, the interaction term of external finance and investment is statistically insignificant for all cases of nested pairwise correlations in which the independent variables are excluded one by one. In this case, the less dependence of SMEs on external financing is affirmed. In addition, the coefficients of controlled variables hold across all cases of 2SLS regression, except for firms' scale.

4.3. Robustness test

To ensure the results' robustness aforementioned previously, we revisit all specifications through the use of alternative variable accounting for investment in the tangible fixed assets and the employment of FEM and 2SLS estimation. The findings evidenced in **Table 7** and **Table 8** are consistent with those reported earlier in tables of the regression result, showing the reduction in investment during the global financial crisis and the less influence of external financing on the investment in the tangible fixed assets in a time of financial crisis. Therefore, the SMEs behave differently with the usage of financing sources during the crisis in which the preference of internal financing over external financing is demonstrated. This implies the priority of SMEs with internal financing sources due to the difficult access to external sources emerging in the time of crisis.

Taken together, based on the nested pairwise approach along with the analytical framework of FEM and 2SLS estimation method, the empirical findings suggest that in a time of uncertainty caused by the financial crisis, SMEs in Vietnam intends to reduce the amount of investment, possibly due to the difficulties related to accessibility to external finance. Therefore, such private firms are more inclined to internal financing for their activities and the investment of SMEs is significantly determined by internal sources coming from their income, rather than the supply of bank finance under the crisis period. This finding could be explained by the pecking order theory, suggesting that firms could prefer internal financing over external funds due to the cost related to agency issues, asymmetric information, and restrictions (Agliardi et al., 2016).

At the same time, the firms with high growth and profitability are not related to the increased pattern of investment, which has been widely discussed in prior studies. This could be explained by the notion that due to precautionary objectives, these well-profitable and revenue-generated able firms could mainly focus on capital and profit accumulation *per se* rather than on the increased investment, particularly for the unforeseen demands in the future, thus making decisions to decrease the investment.

4.4. Further investigation using the quantile regression estimation

The above findings give us the investment's reduction in a time of crisis and the dependence of SMEs' investment on internally generated income, these parts offer more understanding of the different magnitude of the impact of the global financial crisis and financing sources on the dispersion of SMEs' investment. In other words, the distribution tails of SMEs' investment should be tested to show possible changes in the impact of crisis and financing on a different group of investment values. To do this, we employ the quantile regression—a generalisation of median regression approach to other quantiles—to examine whether investment—crisis and investment—

Table 7. Impact of the global financial crisis on investment with the use of Tang_fixassets as dependent variable

| | Fixed-Effect estimation method | | | | Two-stage least square estimation method | | | |
|-----------------------------|--------------------------------|-----------------------|------------------------|------------------------|--|------------------------|------------------------|------------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Crisis | -0.0103*** [-7.16] | -0.0103*** [-7.16] | -0.0183*** [-11.98] | -0.0177*** [-11.50] | 0.0696*** [10.03] | 0.0788*** [10.47] | 0.0770*** [9.97] | 0.0721*** [9.46] |
| Cashflow | 0.212*** [35.28] | 0.246*** [38.60] | 0.259*** [40.36] | 0.261*** [40.53] | -0.0101** [-6.12] | -0.00981*** [-5.96] | -0.00962*** [-5.83] | -0.00919*** [-5.57] |
| Profitability | | | -0.0310*** [-15.68] | -0.0302*** [-15.29] | -0.0280*** [-13.57] | -0.0106*** [-6.66] | -0.0108*** [-6.78] | -0.00735*** [-4.49] |
| Size | | | | -0.0204*** [-14.92] | -0.0203*** [-14.83] | | 0.000763* [1.86] | 0.000909* [2.22] |
| Growth | | | | | -0.0059*** [-3.69] | | | -0.0106*** [-6.09] |
| Constant | 0.00189*** [2.74] | 0.00101 [1.47] | 0.459*** [14.95] | 0.457*** [14.88] | -0.0109*** [-14.80] | -0.0112*** [-15.34] | -0.0285*** [-3.04] | -0.0317*** [-3.38] |
| Adjusted R ² | 0.0271 | 0.0308 | 0.0143 | 0.0150 | 0.0303 | 0.0346 | 0.0342 | 0.0336 |
| F-statistic | 625.65 | 501.55 | 433.83 | 349.89 | 66.2 | 47.96 | 38.75 | 34.75 |
| P-value (F-Statistic) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| F-statistic (Instrument) | | | | | 290.82 | 300.35 | 297.74 | 347.60 |
| P-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: The table shows the results of fixed-effects and two-stage-least-square estimation. The dependent variable, Tang_fixassets regresses on the dummy variable capturing the global financial crisis and other controlled variables including cash flow, profitability, size, and growth. All variable definitions are reported in Table 1. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively. Standard errors are in brackets.

Source: Authors calculation

Table 8. Impact of the global financial crisis on investment depending on the financing sources with the use of Tang_fixassets as dependent variable

| | Fixed-Effect estimation method | | | | Two-stage least square estimation method | | | |
|--------------------------|--------------------------------|------------------------|-----------------------|-----------------------|--|------------------------|-----------------------|-----------------------|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Crisis | -0.010*** [-5.05] | -0.0092*** [-4.62] | -0.021*** [-4.74] | -0.020*** [-4.67] | 0.0167** [2.02] | 0.0204** [2.39] | 0.0191** [2.18] | 0.0202** [2.30] |
| InternalFinance | 0.323*** [37.04] | 0.363*** [39.65] | 0.377*** [41.19] | 0.380*** [41.39] | -0.008*** [-2.69] | -0.0079** [-2.57] | -0.0076** [-2.46] | -0.0077** [-2.49] |
| ExternalFinance | 0.0198*** [3.99] | 0.0203*** [4.11] | 0.0207*** [6.20] | 0.0209*** [6.03] | 0.00426** [2.34] | 0.00513*** [2.81] | 0.00400** [2.00] | 0.00352** [1.77] |
| InCri | 0.0833*** [5.69] | 0.0754*** [5.17] | 0.103*** [7.44] | 0.0994*** [7.14] | 0.137*** [13.97] | 0.137*** [14.06] | 0.137*** [14.04] | 0.134*** [13.67] |
| ExCri | -0.00152 [-0.36] | -0.00204 [-0.48] | 0.00978 [1.32] | 0.0104 [1.41] | 0.00662 [1.27] | 0.00624 [1.20] | 0.00587 [1.13] | 0.00641 [1.23] |
| Profitability | | -0.0371*** [-13.75] | -0.037*** [-13.57] | -0.033*** [-11.44] | -0.030*** [-11.44] | -0.030*** [-3.74] | -0.030*** [-3.77] | -0.030*** [-2.41] |
| Size | | | -0.030*** [-14.64] | -0.029*** [-14.38] | | | 0.001 [1.38] | 0.001 [1.58] |
| Growth | | | | -0.010*** [-4.11] | | | | -0.0078*** [-4.43] |
| Constant | 0.000342 [0.13] | -0.000325 [-0.12] | 0.669*** [14.57] | 0.659*** [14.33] | -0.015*** [-12.55] | -0.0160*** [-13.45] | -0.0298*** [-2.93] | -0.0313*** [-3.08] |
| Adjusted R ² | 0.0531 | 0.0604 | 0.0304 | 0.0318 | 0.0190 | 0.0180 | 0.0185 | 0.0164 |
| F-statistic | 296.03 | 280.37 | 271.33 | 239.70 | 46.61 | 50.64 | 58.58 | 68.12 |
| P-value (F-Statistic) | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| F-statistic (Instrument) | | | | | 553.76 | 552.29 | 558.4 | 476.24 |
| P-value | | | | | 0.000 | 0.000 | 0.000 | 0.000 |

Notes: The table shows the results of fixed-effects and two-stage-least-squares estimation. The dependent variable, Tang_fixassets regresses on internal financing, external financing, the interaction terms between two leading financing sources and the dummy variable capturing the global financial crisis, and other controlled variables including cash flow, profitability, size, and growth. All variable definitions are reported in Table 1. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively. Standard errors are in brackets.

Source: Author's calculation

Table 9. Impact of the global financial crisis on the dispersion of investment: the quantile approach

| | (Q10) | (Q20) | (Q30) | (Q40) | (Q50) | (Q60) | (Q70) | (Q80) | (Q90) |
|---|-----------------------|-----------------------|-----------------------|------------------------|-------------------------|------------------------|-----------------------|-----------------------|----------------------|
| Panel A: Tol_fixassets employed as dependent variable | | | | | | | | | |
| Crisis | -0.024*** [-10.26] | -0.016*** [-12.90] | -0.013*** [-15.10] | -0.009*** [-13.83] | -0.0057*** [-11.49] | -0.0032*** [-9.59] | -0.0038*** [-6.80] | -0.0076*** [-5.18] | -0.010*** [-3.38] |
| Panel B: Tang_fixassets employed as dependent variable | | | | | | | | | |
| Crisis | -0.023*** [-10.19] | -0.016*** [-13.07] | -0.013*** [-15.16] | -0.0093*** [-14.48] | -0.00603*** [-12.55] | -0.0035*** [-11.05] | -0.0041*** [-7.69] | -0.0099*** [-6.99] | -0.014*** [-4.69] |

Notes: The table shows the regression estimates of the impact of the financial crisis on the dispersion of investment level across 1st Quantile (Q10) to 9th Quantile (Q90). For brevity, the main results of the crisis—investment nexus is reported. Proxies for investment are the total fixed assets and the tangible fixed assets, as represented in Panel A and Panel B, respectively. All variable definitions are reported in Table 1. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively. Standard errors are in brackets.

Source: Author's calculation

financing nexus varies across the distribution of investment. One should note that the results from this quantile approach aim to shed further light on the investment dispersion affected by the crisis and financing status, rather than given the assumption that the impact of the financial crisis and financing funds on investment are homogenous. This approach is ignored in previous research, and we are among the first to use this method for a more comprehensive understanding of SMEs' investment behaviours.

Table 10. Impact of the global financial crisis on the dispersion of investment depending on the financing sources

| | (Q10) | (Q20) | (Q30) | (Q40) | (Q50) | (Q60) | (Q70) | (Q80) | (Q90) |
|---|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|----------------------|---------------------|--------------------|
| Panel A: Tol_fixassets employed as dependent variable | | | | | | | | | |
| Internal Finance | 0.381*** [40.55] | 0.313*** [58.69] | 0.274*** [73.64] | 0.223*** [74.22] | 0.171*** [69.63] | 0.104*** [49.70] | 0.0452*** [19.63] | 0.0235*** [3.82] | 0.0193 [1.50] |
| External Finance | 0.022*** [5.44] | 0.012*** [5.02] | 0.007*** [4.23] | 0.005*** [3.91] | 0.004*** [3.45] | 0.003*** [3.05] | 0.007*** [6.89] | 0.015*** [5.53] | 0.002 [0.28] |
| InCri | 0.065*** [3.52] | 0.056*** [5.43] | 0.052*** [7.18] | 0.050*** [8.46] | 0.044*** [9.26] | 0.037*** [9.02] | 0.023*** [5.08] | 0.030** [2.54] | 0.009 [0.37] |
| ExCri | -0.013 [-1.25] | -0.009 [-1.43] | -0.001 [-0.30] | 0.00206 [0.60] | 0.0007 [0.26] | 0.0016 [0.69] | -0.0001 [-0.02] | 0.017** [2.35] | 0.056*** [3.80] |
| Panel B: Tang_fixassets employed as dependent variable | | | | | | | | | |
| Internal Finance | 0.375*** [39.96] | 0.309*** [59.80] | 0.271*** [76.12] | 0.221*** [75.89] | 0.168*** [69.77] | 0.102*** [50.67] | 0.044*** [19.84] | 0.022*** [3.52] | 0.004 [0.31] |
| External Finance | 0.023*** [5.62] | 0.011*** [4.96] | 0.007*** [4.52] | 0.005*** [3.91] | 0.004*** [3.45] | 0.003*** [3.14] | 0.007*** [6.88] | 0.014*** [5.37] | 0.004 [0.77] |
| InCri | 0.057*** [3.10] | 0.054*** [5.40] | 0.052*** [7.48] | 0.048*** [8.54] | 0.0451*** [9.62] | 0.034*** [8.78] | 0.022*** [5.17] | 0.024** [2.01] | -0.002 [-0.07] |
| ExCri | -0.013 [-1.18] | -0.008 [-1.42] | -0.001 [-0.25] | 0.001 [0.43] | 0.0001 [0.04] | 0.001 [0.51] | -0.0005 [-0.22] | 0.008 [1.10] | 0.055*** [3.88] |

Note: The table shows the regression estimates of the impact of financing sources on the dispersion of investment level across 1st Quantile (Q10) to 9th Quantile (Q90). For brevity, the main results of the crisis—investment nexus is reported. Proxies for investment are the total fixed assets and the tangible fixed assets, as represented in Panel A and Panel B, respectively. All variable definitions are reported in Table 1. ***, **, and * denote the significance level of 1%, 5%, and 10%, respectively. Standard errors are in brackets.

Source: Author's calculation

Panel A of [Table 9](#) shows the effect of the financial crisis on the dispersion of investment levels in the total fixed assets, employing the quantile estimation. We observe the reduction in investment during the crisis across all quantiles of SMEs' investment level, similar to those aforementioned previously. In addition, the magnitude of coefficients for the nexus between the global financial crisis and investment significantly decreases with the increase of quantiles (e.g., -0.024 in the first quantile and -0.0038 in the seventh quantile) before increasing in magnitude for the last two quantiles. This implies that the strongest magnitude in investment-crisis relationships exist dominantly at both ends of the distribution tail of the investment level. These findings display the same pattern in Panel B of [Table 9](#) when using the tangible fixed assets as the dependent variable.

Panel A of [Table 10](#) reports the dependence of investment on financing sources during the financial crisis when considering the different levels of investment in the total fixed assets based on the quantile approach. We observe that SMEs positively depend more on both internal and external financing sources, especially close to the low quantiles. However, when considering the global financial crisis, SMEs are more reliant on internally generated income than externally bank financing, which is pronounced in the low and medium quantiles. These results support the findings found previously and occur in the same pattern of Panel B, also reported in [Table 10](#).

5. Conclusion

SMEs are recently considered as an important driving force for the economic development of emerging countries. However, SMEs experience many difficulties in making financing decisions for investment projects. To be specific, SMEs face internal capital constraints (e.g., mainly collected from internal retained earnings or close relationships with friends or families) and difficulty in accessing external financial sources (e.g., mainly loan supply from the banking system). Moreover, these financial decisions will be highly under constraint during times of instability and uncertainty caused by the economic crisis. Furthermore, little is known about the SMEs' behaviours in investment and financing depending on the impact of the global financial crisis, which is central to our study contributing to the existing literature on the investment and financing behaviour of SMEs during the crisis period.

Using the unique database from a survey of SMEs together with appropriate estimation methods covering the period of 2008–2016, the paper aims to provide empirical evidence on the impact of the 2008–2010 financial crisis on changes in Vietnamese SMEs' investment behaviour. Additionally, the study provides evidence of the financing-investment nexus under the crisis period. First, we find that Vietnam's SMEs tend to cut back investment expenditures due to the impact of the crisis. According to Q-theory, firms with growth possibilities might raise investment (Rousseau & Kim, 2008). Imperfections in financial markets resulting from the financial crisis may force SMEs to face varied levels of funding limitations and therefore implement the relevant investments (Kasahara, 2008). Investments decline as a result (Kahle & Stulz, 2013).

Second, these firms are dependent both on internal and external financing, but under times of uncertainty from the financial crisis, the internal finance generated by firms' income is preferred over the supply of bank finance. From the theoretical perspective of the pecking order theory combined with imperfect financial markets, SMEs prefer internal funding over external finance owing to asymmetric information, agency difficulties and management control limits (Agliardi et al., 2016). Under the consequences of the financial crisis, these enterprises have significant financial frictions due to uncertainties in alternatively external financing sources (Akiyoshi & Kobayashi, 2010). This confirms the important role of internal financing sources in increasing more investment in total fixed assets, given the fact that financing funds from banks and capital markets are not easy to access due to existing constraints of the distinct characteristics of SMEs such as a high level of asymmetric information and lower value of the collateral.

These findings could imply some policy recommendations for policy-makers to assist SMEs in obtaining access to external capital (e.g., credit financing sources from banks) in a convenient way, helping SMEs not to be affected unnecessarily by the serious consequences of the financial crisis.

These results highlight the critical role of internal financing in facing difficulties caused by the financial crisis. The policy-makers could initiate the support policy for SMEs' finance demand in an attempt to facilitate credit in the difficult macroeconomic period such as financial crises. In this vein, they should ensure the available external financing source to alleviate the damaging impact on the behaviour of SMEs' investment driven by the aftermath of the global financial crisis and the occurrence of unexpected economic events. In addition, SMEs could draw some implication based on these research findings. For instance, SMEs should actively reduce their investment as soon as possible to reserve financial resources to cope with similar crises. By the accumulation of financing sources, SMEs could remain resilient when dealing with crises and proactively respond to the crisis period by immediately starting up the working mechanism, cutting cost, and restructuring their core business.

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