SME Credit Constraints in Asia's Rising Economic Star: Fresh Empirical Evidence from Vietnam

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Abstract. This study provides a fresh look at the SME sector's economic backbone vis-à-vis credit constraint dichotomy in Vietnam—Asia's rising economic star. The study uses data from the Survey of Manufacturing SMEs in Vietnam from 2005 to 2013 and adopts a two-step Heckman modelling strategy to single out firms with formal financing needs that are credit constrained. Results show that several characteristics—including firm size, investment, financial assets, leverage, equity, registration, gender of owner, age, and education—significantly affect the likelihood of either credit constraints or demand. The main results do not change even when the issue of endogeneity is dealt with. Particularly, we provide evidence that unobserved factors that increase the probability of debt demand also increase the probability of being constrained. Policy implications are discussed.

Keywords: credit demand, credit constraints, panel data, Vietnam

JEL classification: C23, O16, O53

I. Introduction

It is now widely accepted that a country's small and medium-sized enterprise (SME) sector is the “engine” of its economic growth and development. Indeed, SMEs usually account for the majority of enterprises in a country and a significant share of employment (Hallberg 2000). In developing Asian economies, SMEs occupy approximately 90% of all business entities and are the primary private sector employers, providing 50–80% of all jobs (Tambunan 2008). They also contribute more substantially to a country's gross domestic product (GDP) than do their larger counterparts. In the Southeast Asia region, SMEs make up 97–99% of all enterprises, contributing significantly to GDP of each country—for instance, 46% in Singapore, 57% in Indonesia, and about 40% in other countries (Shinozaki 2012).

Across countries and regions, the SME sector appears to be persistently credit constrained; not only do SMEs experience greater financing obstacles than their larger counterparts, but the effect of such constraints also appears greater compared to larger firms (e.g., Beck, Demirgüç-Kunt, and Maksimovic 2005, Beck et al. 2006). This ostensible paradox—economic significance vis-à-vis perceived and documented financing constraints—provides, and indeed has inspired, a growing body of literature investigating the generic and country-specific drivers and obstacles to financing the SME sector.

Earlier studies have investigated the determinants of credit constraints in various countries and regions. The issue has been studied, albeit not sufficiently, in the case of Vietnam as well—our country of interest—Asia's rising economic star. In less than a quarter of a century, Vietnam's economy has transcended from one of the poorest in the world, with a per capita income of around US\$100, to around US\$2,100 by the end of 2015, a 20-plus-fold surge. However, Vietnam remains a developing, lower-middle income economy, substantially dependent on the SME sector for further growth and development (e.g., Triodos Facet 2013). It would seem that, on the one hand, the SME sector might have played a key role in advancing Vietnam's economic status, but on the other, remains constrained (CIEM 2014). This backdrop provides an interesting setting for a closer investigation of the SME financing constraint challenges—especially, the question regarding the nature of constraints.

This study uses data from the Survey of Small and Medium Scale Manufacturing Enterprises in Vietnam conducted biennially in ten provinces across Vietnam under the joint research collaboration between Vietnam and Denmark over the 2005–2013 period. This study is the first to use this longitudinal dataset to investigate determinants of SME credit constraints in Vietnam. Whilst previous studies have tended to combine credit constraints and credit demand (e.g., Tran and Santarelli 2013), our study deviates from that trend by separating constraints and

demand using the Heckman two-step probit model. Specifically, we estimate credit demand in the first step and calculate the inverse Mill's ratio from it in the second step to estimate determinants of credit constraints. In doing so, this study contributes to literature by singling out the effect of credit demand, then allows the second step to focus on estimating the effects of explanatory variables on the likelihood that firms with credit demand are constrained. Another important contribution of the study is to deal with the issue of endogeneity that is likely to arise in the case of some independent variables such as firm size and revenue growth.

Results obtained from the Heckman model show that firm and owner characteristics do affect the probability of credit demand and constraints. In the first step, we find that firm size and investment are positively related to credit demand. Firms with higher levels of financial assets require more external credit; however, those with higher levels of owner's equity are less dependent on external financing. As well, officially registered firms tend to have greater demand for credit. Male entrepreneurs are less likely to seek formal credit, while age of owner decreases the probability of firms seeking credit and holding debt. Firms run by highly educated owners are also less likely to demonstrate demand for external financing.

In the second step, we find that larger firms tend to be more constrained. Similarly, firms with a higher level of investment and leverage are more likely to be constrained as well. This study also finds that firms run by older owners are less likely to be credit constrained. Further, we provide evidence of the selection term that unobserved factors that increase the probability of debt demand also increase the probability of being constrained. Therefore, our findings imply that policy makers might consider working with credit lenders to better satisfy firm's credit demands, for example, by offering diversified lending packages so that firms are able to have their demands met.

The rest of the paper is structured as follows. Section II provides the context of the study. Section III briefly reviews the concept of credit constraint and the relevant literature relating to Vietnam and other countries. Section IV outlines the data, variables, and methodology. Section V presents the results, while Section VI concludes with some policy implications.

II. Study Context

Officially a socialist republic, Vietnam is the easternmost country on the Indo-China Peninsula in Southeast Asia. According to the 2016 World Bank report, Vietnam is the 14th most populous country in the world, and the 8th most populous in Asia, with an estimated 91.7 million inhabitants. The country's GDP was US\$193.6 billion, growing at 6.7% per annum, and inflation was recorded at 0.6%. In the ASEAN economy, Vietnam's economic growth was higher than Thailand's (2.8%), Indonesia's (4.8%), Malaysia's (5.0%), the Philippines' (5.8%), but lower than China's (6.9%) (World Bank 2016). Vietnam has witnessed a remarkable increase in per capita income from

US\$100 in the 1980s to US\$2,100 in 2015. Per capita GDP is expected to grow at a minimum of 6% per year to reach the US\$18,000 mark by 2035, placing this country among the fastest-growing economies in the world. Indeed, Vietnam has rapidly become Asia's rising economic star.

SMEs make up more than 81% of all enterprises in Vietnam (Dinh 2014), contributing approximate 40% of GDP, creating 51% of employment, and 31% of export turnover. Recognising the importance of SMEs as well as of their challenges in accessing capital, the government has initiated many supporting policies for the growth and development of the sector over the past decade. Initially and most importantly, Decree No. 90/2001/ND-CP was promulgated in January 2001 to provide state support for SME development. Eight years later, the government promulgated Decree No. 56/2009/ND-CP in June 2009, which determined eight groups of supporting policies for SMEs in terms of financing, production space, innovation and technological capacity, market expansion, procurement plans and public services, information and consultation, human resources development, and business incubators. Of these, financing has received the most attention.

III. Literature Review

Credit constraint refers to a limitation or restriction on borrowing from the formal financial sector by various economic agents, including individuals, households, and businesses (Bigsten et al. 2003; Chaves 2001; Feder et al. 1990). Since the late 1980s, several studies have examined determinants of credit constraints, mainly at the firm level. Most have suggested that both firm and owner characteristics influence the nature and extent of constraints (Bigsten et al. 2003; Rand 2007; Tran and Santarelli 2013).

Credit Constraints of Firms in Vietnam

Key findings and methodologies of previous studies on credit constraints of firms in Vietnam are presented in Table 1. As the table shows, only six studies have attempted to investigate the issue. In defining credit constraint, the approach has commonly been binary—constraint or no constraint. The regression techniques have included probit, logit, and random-effects probit. Data sources have been household, SMEs, and World Bank Enterprise surveys. These studies show that a considerable proportion of households and SMEs remains credit constrained, with rural areas and male-owned firms appearing to be more disadvantaged. Household enterprises tend to be less constrained than private firms, limited, or share-holding companies. Older owners are less likely to encounter credit constraints compared to younger owners.

[Insert Table 1 here]

Credit Constraints of Firms in Other Countries

In the case of the United States, Jappelli (1990), using logit estimations on a binary approach of constraints, finds current income, wealth, and age as key determinants of credit constraints. Bigsten et al. (2003) use fixed- and random-effects probit estimations to analyse credit constraints of manufacturing firms in Africa. The authors conclude that firm size significantly and negatively affects the likelihood of constraint. Further, profitable firms tend to have their loan applications approved, while highly indebted firms are less likely to obtain further credit due to risk of bankruptcy. Applying biprobit estimates, Byiers et al. (2010) show a negative relationship between firm size and credit constraints in the case of Mozambican manufacturing enterprises. Moreover, manager education and firm networking are negatively associated with constraints. Kira (2013) identifies determinants of financing obstacles for firms in five East African countries, using data from the World Bank Enterprise Surveys. Ordered probit and multivariate regression models are applied to show that financing constraints mostly affect SMEs and that the constraints appear to have a larger effect on small and young enterprises. Based on an official credit rating of firm capacity in satisfying financial obligations, Bottazzi, Secchi, and Tamagni (2014), in the case of Italy, classify constraints into three classes, including non-financially constrained, mildly financially constrained, and highly financially constrained firms¹. The study finds that financial constraints prevent young, fast-growing firms from taking business opportunities, as well as affecting the growth potentials of slow-growing firms.

In general, the literature appears to be confined to either one-year cross-sectional or limited panel data (at the most, three surveys) and the issue of endogeneity is often ignored. In this paper, we propose that the issue of endogeneity should be adequately addressed. For example, larger firms might be less constrained but, on the other hand, constrained firms are less likely to expand. Endogeneity might also arise from firm's or owner's unobserved characteristics that influence both constraints and size of firms (see, for example, Byiers et al. 2010; Beck, Demirgüç-Kunt, and Maksimovic 2008, Fagiolo and Luzzi 2006, Musso and Schiavo 2008). Anyiro and Oriaku (2011) emphasise the relationship between experience and access to formal credit, while Tran and Santarelli (2013) find a significant connection between owner's experience in the industry and the likelihood that firms are constrained. Pansiri and Temtime (2008) find that managerial skills and organisational structure affect SMEs' resources, including finance, human and material. Additionally, unobserved factors such as managerial skills, human capital, or industry characteristics might also cause endogeneity (Astbro and Bernhardt 2005; Colombo, Delmastro, and Grilli 2004; Peng and

¹ Bottazzi, Secchi, and Tamagni (2014) relied on the rating index of creditworthiness instead of self-reported responses in questionnaire to classify three groups of financial constraints.

Heath,1996; Salojärvi, Furu, and Sveiby, 2005). In sum, extant literature, in examining the determinants of credit constraints, has primarily explored firm and owner characteristics (Akoten, Sawada, and Otsuka 2006; Rand 2007; Tran and Santarelli 2013) without handling endogeneity. Our study provides fresh evidence on firm credit constraints in a developing economy, while attempting to adequately address endogeneity issues.

IV. Data, Variables, and Methodology

Data

This study employs data from the Survey of Small and Medium Scale Manufacturing Enterprises (SME). The SME survey was conducted biennially from 2005 to 2013 in ten of the 64 provinces across Vietnam². Sponsored by the Danish International Development Agency (DANIDA, Denmark), the survey has been a research collaboration among the Central Institute for Economic Management (CIEM, Vietnam), the Institute of Labour Science and Social Affairs (ILSSA, Vietnam), and the Department of Economics (DoE) of the University of Copenhagen (Denmark). A key objective of the survey has been to generate fresh evidence and crucial information on the actual dynamics and growth of SMEs in Vietnam. Data and information are collected through face-to-face interviews with firm's representatives, covering all firm-related issues, including firm characteristics; enterprises growth and dynamics (employment growth and business turnover); bureaucracy, informality, and informal payments; investment and access to finance; production, technology, and labour productivity; employment; environment; trade and sales structures. Over 2,500 registered and unregistered manufacturing SMEs were interviewed in each round, with a response rate of 98%.

Variables

Definitions and predicted signs of variables used in the study are provided in Table 2. We rely on self-reported responses of owners or managers to construct the key dependent variable—credit *constraint*, where 1 equals a firm with credit demand but its loan applications were rejected or where loans were approved, demand is not fully met, and 0 equals a firm with fully approved loans with no further demand, or those who did not apply for a loan but do hold some formal borrowings (hereafter, positive debt) on their balance sheets. Credit *demand* is a binary variable as well, where 1 equals a firm that has applied for loans or holds positive debt, and 0 equals a firm with neither loan applications nor positive deb holding. The construction of this variable allows us to separate the notion of demand from constraint. Independent variables are selected mostly from extant literature

² Ho Chi Minh City, Ha Noi, Hai Phong, Long An, Ha Tay, Quang Nam, Phu Tho, Nghe An, Khanh Hoa, and Lam Dong. Regardless of the merger into Ha Noi since 2008, Ha Tay continues to be regarded as a separate province to ensure the consistency of the sample over years and make it comparable to previous surveys.

and include revenue growth, number of employees (log.), firm age, firm type, investment, share of debt, financial assets, equity, debt failure, registration, network size, gender of owner, age of owner, and education. Two instruments (sector size and sector growth), following Kumar, Rajan, and Zingales (1999), are used to manage endogeneity of firm size and revenue growth on the probability of firms to be constrained. Further, the paper controls for location and timing effects.

[Insert Table 2 here]

Methods

This paper adopts the two-step Heckman probit model to separate the determinants of demand for credit from the determinants of credit constraint. This econometric strategy has been used in previous studies on firm's credit constraints (see, e.g., Jiménez et al. 2014; Manova 2012; Minetti and Zhu 2011). Technically, the first step is to estimate which firms have a need for formal financing by running a regression of financing needs on a set of variables. In the second step, we identify among firms with formal financing needs, which ones are credit constrained. This approach is advantageous in flushing out the effect of credit demands in the first step, then allowing the second step to focus on estimating the effects of factors that influence the probability of firms to be constrained. Basically, credit constraints are observed when firms have positive credit demand.

The first step: Credit demand equation

$$D_{it} = 1[D_{it}^* > 0], \quad (1)$$

where D_{it} represents credit demand, coded 1 if a firm has a need for credit and 0 otherwise; D_{it}^* is the latent variable that denotes the unobservable variable of credit demand of firm i at time t and defined as

$$D_{it}^* = X_{1it}\beta + \varepsilon_{1it}. \quad (2)$$

From Equations (1) and (2), we have a credit demand equation as follows:

$$D_{it} = 1[X_{1it}\beta + \varepsilon_{1it} > 0], \quad (3)$$

where X_{1it} is observable time varying and time invariant vector of firm characteristics that influence credit demand; ε_{1it} is a random error term, which is a function of the individual specific unobserved effect c_i and a normally distributed disturbance with zero mean u_{it} , $u_{it} \sim IN(0, \sigma_u^2)$.

The second step: Credit constraint equation

$$C_{it} = 1[C_{it}^* > 0], \quad (4)$$

where C_{it} represents credit constraint, coded 1 if a firm is constrained and 0 otherwise; C_{it}^* is the latent variable that denotes the unobservable variable of credit constraints of firm I at time t and defined as

$$C_{it}^* = X_{2it}\gamma + \varepsilon_{2it} \quad (5)$$

Equations (4) and (5) lead to a credit constraint equation as follows:

$$C_{it} = 1[X_{2it}\gamma + \varepsilon_{2it} > 0] \quad (6)$$

where X_{2it} is observable time varying and time invariant vector of firm characteristics that influence credit constraints; ε_{2it} is a random error term for firm i .

Assumption

The Heckman model uses the assumption that both error terms ε_{1it} and ε_{2it} are normally distributed with mean 0, variance of the error terms $\sigma_{\varepsilon_1}^2$ and $\sigma_{\varepsilon_2}^2$, and the correlation coefficient $\rho_{\varepsilon_1\varepsilon_2}$ as follows:

$$(\varepsilon_{1it}, \varepsilon_{2it}) \sim N(0, 0, \sigma_{\varepsilon_1}^2, \sigma_{\varepsilon_2}^2, \rho_{\varepsilon_1\varepsilon_2}) \quad (7)$$

where $(\varepsilon_{1it}, \varepsilon_{2it})$ is independent of X_{1it} and X_{2it} .

A key challenge is that in regressing credit demand on characteristics of firms participating in formal credit markets, we are not able to observe the whole population. Those participating in the formal markets appear to have higher credit demand than those who do not—and also, because of external credit needs, they tend to be active in the formal markets. Therefore, the results might be biased, or known as sample selection bias, which leads to biased results when estimating the connection of other factors that affect credit constraints. Hence, according to the Heckman modelling strategy, the inverse Mill's ratio generated from Equation (3) is used to deal with the selection bias problem. This ratio basically captures the probability density function over the cumulative distribution function of a distribution. The equation function for C_{it} in the selected sample is given as

$$E(C_{it}|D_{it} = 1, X_{1it}) = X_{1it}\beta + E(\varepsilon_{1it}|D_{it} = 1, X_{1it}) \quad (8)$$

Given the assumption above regarding the normal distribution, Equation (8) can be re-phrased as

$$C_{it} = X_{1it}\beta + \frac{\varphi(D_{it})}{\Phi(D_{it})}\gamma \quad (9)$$

where $\frac{\varphi(D_{it})}{\Phi(D_{it})}$ is the inverse Mill's ratio; $\varphi(D_{it})$ and $\Phi(D_{it})$ are the probability and cumulative distribution functions, respectively.

V. Results

Descriptive statistics

Table 3 reports the descriptive statistics of variables used in the study. On average, 34.3% of firms applied for bank loans and 54% held positive debt. Around 58% required external credit; of which, 36.7% were constrained. The average revenue growth was 9.1%, while the average number of employees was 13. Firms were, on average, 15 years of age. In the sample, 71.6% were household businesses, while the remaining consists of various types, such as cooperatives, limited companies, etc. On average, firms spent 457.6 million VND (approximate US\$25,596) on investments and remained 9.7% of debt ratio in their capital structure. Further, on average, firms had 554.4 million VND in financial assets (equivalent to US\$31,000) and 3,472 million VND in equity (equivalent to US\$194,190). Firms belong to, on average, nearly 32 business associations. Around 67% were run by male entrepreneurs. The average age of owners was 46 and 25% of firm owners are well educated.

Table 3 also presents the descriptive statistics by constraint and simple *t*-tests. As the table shows, constrained firms have a higher level of revenue growth than their peers. This group of firms is larger sized, as measured by number of employees. Constrained firms have higher levels of investment as well as financial assets and owner's equity. Not only are constrained firms more likely to be officially registered but they also engage in more business associations. This group of firms is likely run by well-educated owners.

[Insert Table 3 here]

Empirical results

Firm's credit demand

As indicated, the two-step Heckman probit model is adopted to estimate determinants of credit demands of SMEs in Vietnam in the first step. The estimated coefficients of firm's credit demand equation and their associated average partial effects are reported in Table 4. Generally, columns [1] and [3] show results when credit demand is decomposed into two components, including applying for loans and debt holding, while the results of credit demand equation appear in column [5].

Firm size has a positive and significant relationship with the probability that firms apply for loans or hold debt. The average partial effects show that larger firms have a higher likelihood of applying for loans by 5.2% (column [2]) as well as holding debt by 5.8% (column [4]) than smaller firms, holding other factors constant. In other words, larger firms are more likely to express their demand for credit (column [3]), consistent with Bigsten et al. (2003) and Byiers et al. (2010) who show that credit demand increases with firm size.

Similar to firm size, the coefficient of investment is positive and significant in our estimations of loan application, debt holding, and credit demand (columns [1], [3], and [5]). A 1% increase of investment leads to a higher probability of firms applying for loans, holding debt, and demanding credit by 3.0%, 2.6%, and 2.9%, respectively—holding other things constant. Those with higher investment opportunities are expected to be more profitable (Drakos and Giannakopoulos 2011); hence, they demand more credit to run their businesses. Apparently, the level of investment increases firm's credit demand.

In terms of financial assets, the results show that firms with higher levels of financial assets tend to apply more for loans and hold more debt as well as demonstrate a stronger need for credit. A 1% increase of financial assets helps to increase the probability of loan application by 1.8% (column [2]), debt holding by 4.1% (column [4]), and credit demand by 3.5% (column [6])—holding other things unchanged. Our findings are consistent with Rand (2007) who finds that financial assets are positively associated with the debt share that firms wish to hold. Contrary to financial assets, owner's equity imposes a negative and significant impact on the likelihood that firms applied for loans, held debt, and demanded credit. As reported, the higher the level of owner's equity, the lower probability of loan application and debt holding.

Registration has a significant and positive impact only on the probability that firms applied for loans (column [1]). The average partial effects show that registered firms are more likely to apply for loans by 3.8% (column [2]), holding other things constant. Earlier studies have shown that formal registration may help firms gain easier credit access (McKenzie and Sakho 2010; Rand and Torm 2012). Registered firms tend to have higher credit demands exacerbated by registration costs and dishonest practices (Rand and Tarp 2012; Schneider and Ernste 2000).

In terms of owner characteristics, female-run firms are more likely to apply for loans (column [1]). Our findings are consistent with Yaldiz, Altunbas, and Bazzana (2011) who find that women entrepreneurs tend to have more demand and better access to formal credit because of their better education and business skills. In the same vein, Barslund and Tarp (2008) and Chaudhuri and Cherical (2011) emphasise a higher opportunity of women as compared to men in having access to credit. The coefficient of owner's age is negative and significant in the estimations of firm application, debt holding, and credit demand. The average partial effects show that a 1% increase of owner's age decreases the probability that firms apply for loans, hold debt, and demand credit by 0.2% (columns [2], [4], and [6])—holding other things constant. As suggested by Coleman (2002), older owners are more likely to be risk averse, making them less willing to demand external financing. Firms with highly educated owners are less likely to express their credit demand, perhaps because higher education level helps owners utilise their own capital

sources more productively (Duong and Izumida 2002). The result is significant and negative in column [5] only, showing that firms run by educated owners have a lower likelihood of demanding formal credit by 3.1% (column [6]). We find no significant evidence of the impact of revenue growth, firm age, firm type, registration, and gender on firm's credit demand.

[Insert Table 4 here]

Firm's credit constraints

Credit constraints estimations are run in the second step following Heckman approach. In this step, the inverse Mill's ratio obtained and calculated from the first step is used to deal with sample selection bias. Basically, among firms having credit demand estimated in the first step, we examine those being credit constrained in the second step. Table 5 presents the determinants of credit constraints with two specifications with and without selection term.

Firm size as measured by the logarithm of number of employees is significantly and positively associated with the likelihood that firms are credit constrained in both specifications—with and without the selection term, indicating that external credit demands of larger firms are not fully met. The average partial effects show that in the adjusted specification (column [4]), a 1% increase of firm size leads to 4.8% increase of that likelihood—holding other factors unchanged. A possible explanation is that the monitoring costs represented by larger firms remain lower compared to potential loan sizes and returns as a consequence of the credit market imperfections, especially in developing countries. Our findings are consistent with Byiers et al. (2010) and Tran and Santarelli (2013).

Similar to firm size, the coefficient of investment is positive and significant, implying that the investment level increases the probability of being constrained, e.g., firms with higher levels of investment have higher external credit demands which are not fully met. Holding other factors constant, the probability of constraint goes up by 1.8% when firms increase their investment level by 1% (column [2]). Our findings are in line with Tran and Santarelli (2013) who highlight a positive relationship of investment and the probability of firms to be capital constrained. Firms making investment may be discouraged from applying for loans based on adverse selection and moral hazard problems (Berger and Udell 2002) and are thus more constrained.

The share of debt exerts a strong association with credit constraints. This variable refers to a firm's leverage, suggesting that firms with a higher leverage are more likely to be credit constrained. The average partial effects show an increase of the probability by 11.4% and 12.3% in both specifications with and without the selection terms (columns [2] and [4], respectively). It

is possible that high debt-asset ratios make creditors anxious about repayment prospects (Berger and Udell 2002), resulting in credit demands not being fully met.

We find that the age of owner is significantly and negatively associated with the probability of credit constraints—firms run by older owners are less likely to be constrained. Our findings concur with the literature (Akoten, Sawada, and Otsuka 2006; Tran and Santarelli 2013). Doan, Gibson, and Holmes (2010) find that financial institutions prefer lending to firms with older owners, based on past positive repayment experience. Yaldiz, Altunbas, and Bazzana (2011) show that creditors prefer to lend to firms with older owners with better financial and managerial experience and skills.

The positive and significant selection term implies that unobserved factors that increase the probability of debt demand also increase the probability of being constrained – a 1% increase of credit demands leads to an increase of the likelihood that firms are constrained by 5.3%. This study finds no significant evidence of the influence of revenue growth, firm age, firm type, registration, network size, gender of owner, and education on firm's credit constraints.

[Insert Table 5 here]

Robustness checks

We are concerned that firm size and revenue growth might be endogenous as explained in a previous section. Thus, in this section, we follow Durbin (1954), Hausman (1978) and Wu (1973) to adopt a two-stage strategy and the 2SLS models to check the presence of endogeneity of firm size and growth on credit constraints. The instruments include sector size and sector growth, calculated as the average of firm size and average of revenue growth by sector, respectively, following Kumar, Rajan, and Zingales (1999). This measure is expected to correlate with firm size. Similarly, average revenue growth by sector is estimated to test endogeneity of revenue growth. Technically, as firm size and revenue growth are suspected to be endogenous, we run two reduced-form specifications of these variables on a set of independent variables and instruments in the first stage as:

$$Size_{it} = X_{it}\gamma_1 + Z_{1it}\gamma_2 + Error \quad (10)$$

$$Growth_{it} = X_{it}\gamma_1 + Z_{2it}\gamma_2 + Error \quad (11)$$

where $Size_{it}$ and $Growth_{it}$ denote firm size and revenue growth, respectively, of firm i at time t . X_{it} is the observed time varying and invariant factors. Z_{kit} ($k = 1, 2$) represents instruments to address endogeneity, including sector size and sector growth.

We next obtain the residuals of $Size_{it}$ and $Growth_{it}$ —represented by $Size_{it}^{Res}$ and $Growth_{it}^{Res}$ — and include in the second stage. This is the so-called control function approach—see Wooldridge (2015). Structural equations in the second stage are given as:

$$CC_{it}^* = X_{it}\delta_1 + Size_{it}^{Res}\delta_{21} + Error \quad (12)$$

$$CC_{it}^* = X_{it}\delta_1 + Growth_{it}^{Res}\delta_{22} + Error \quad (13)$$

where δ_{2i} ($i = 1, 2$) captures the coefficients of $Size_{it}^{Res}$ and $Growth_{it}^{Res}$ in the structural equations.

The key idea of this strategy is to test whether $Size_{it}^{Res}$ and $Growth_{it}^{Res}$ are statistically significant. The Durbin-Wu-Hausman test of endogeneity is conducted by testing the null hypothesis $H_0: \delta_{2i} = 0$ ($i = 1, 2$). If the null hypothesis is not rejected, we can conclude that $Size_{it}$ and $Growth_{it}$ are exogenous and that endogeneity does not statistically and significantly affect our main findings.

Due to the difficulty in finding instruments to test endogeneity of firm size and revenue growth on credit constraints (other studies usually show the inverse way, in which credit constraints are suspected to be endogenous on firm size or firm growth), this study ends up with those two instruments. Results show that endogeneity of firm size and firm growth on credit constraints do not significantly affect our main findings.

Table 6 reports test for endogeneity of firm size and revenue growth on credit constraints (Panels A and B, respectively) by adopting two approaches, including the two-stage strategy and 2SLS estimation. The insignificant χ^2 statistics from Hausman test (P -value > 0.1) in both Panels suggest that we cannot reject the null hypothesis that firm size and revenue growth are exogenous, implying that our main empirical findings are robust. The weak instrument test reports significant χ^2 statistics (P -value = 0.000), showing that we reject the null hypothesis of weak instruments. This test confirms the power of our instrumental variables. Apparently, our main findings in previous section are robust with respect to endogeneity.

[Insert Table 6 here]

VI. Conclusion

On one hand, the SME sector is considered a country's engine of economic growth and development; on the other, worldwide, constraints to credit by the sector remains a persistent challenge. The contributions are twofold. First, this study contributes to the literature by using a longitudinal dataset to identify factors that influence credit constraints of firms in Vietnam—Asia's rising economic star. The longitudinal data from the Surveys of Manufacturing SME allow

us to provide a deeper understanding of SME-related issues and of the socio-economic context in Vietnam. Second, another contribution of our study is to adequately investigate whether firm size and revenue growth are endogenous to credit constraints. This study employs the Heckman two-step econometric strategy to first estimate which firms demand credit followed by an estimate of which of these are credit constrained. This two-step approach enables us to eliminate the sample selection bias by flushing out the effect of credit demand, then focusing on identifying determinants of firm's credit constraints. Apart from firm characteristics, this study finds a positive and significant coefficient of the selection term, suggesting that unobserved factors that increase the probability of debt demand also increase the probability of being constrained. Policy makers might consider working with credit suppliers in better managing the demands of SMEs in Vietnam, such as diversifying credit packages by duration and interest rates to fit firm demands. The main results are robust with respect to endogeneity. Our study opens room for future research on the association between credit constraints and firm growth.

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Disclosure statement

I have disclosed those interests fully to Taylor & Francis, and have in place an approved plan for managing any potential conflicts arising from this arrangement.

Appendix

[Insert Table A1 here]

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