LOCAL FINANCIAL DEVELOPMENT AND ECONOMIC GROWTH IN VIET NAM

Dissertation zur Erlangung des Doktorgrades
der Wirtschaftswissenschaftlichen Fakultät
der Georg-August-Universität Göttingen

vorgelegt von

TRAN TUAN VIET
geboren in Hanoi, Vietnam

Göttingen, April 2019

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Tag der Abgabe der Arbeit: 20. 03. 2019

Tag der mündlichen Prüfung: 26. 04. 2019

Acknowledgements

First of all, I would like to express my gratitude to Prof. Dr. Helmut Herwartz for his extremely valuable support throughout my doctoral studies. His outstanding guidance, motivation and tireless efforts for improvement were essential factors for the completion of this thesis. I had also the privilege to collaborate with him in three works, which constitute Chapters 2, 3 and 5 of this thesis. I am very grateful for his confidence and his encouragement in times of doubt. I would also like to thank Prof. Dr. Stephan Klasen for taking the role as the second supervisor and his supportive advice through semi-annual discussions. I also would like to thank Prof. Dr. Sebastian Vollmer for his proof-reading and advice for my first paper and valuable comments in many per semester discussions.

Furthermore, I would like to thank my co-author Dr. Yabibal M. Walle. I have benefited from the collaborations with him in three articles presented in Chapters 2, 3 and 5, and have been motivated by his constructive and inspiring supports. I also thank the colleagues from the Chairs of Econometrics and Statistics for providing wonderful working environment and organizing many exciting activities.

I also thank the Vietnam National University of Forestry (VNUF) and Ministry of Education and Training of Vietnam (MOET) that have funded me with scholarships during the years of my study in Germany. I also thank the International Office of the University of Goettingen for financially supporting me when my scholarship expired.

I would like to thank my friends from Vietnam, Germany and abroad who encouraged me to pursue this endeavour, and provided valuable supports not only in studying but also in my daily life.

Finally, my deepest thank goes to my beloved family, especially my wife (Nguyet) and my daughter (Minh Anh), for being understanding and providing countless support during the past years. I thank my mothers, my fathers, my brothers, my sisters and my relatives for their unreserved love and confidence. Without their confidence, support and encouragement neither my studies nor the completion of this thesis would have been possible.

Declaration of article contributions

This thesis contains four independent studies which have submitted to peer-reviewed journals. In the following, I describe the contributions of my co-authors and myself.

Viet T. Tran, Yabibal M. Walle, and Helmut Herwartz

Local financial development and household welfare in Vietnam: Evidence from a panel survey

This article has been published in *Journal of Development Studies, 2018, 54(4), 619-640.*

My contributions to the article are the followings:

- I was in charge of preparation of the data, cleaning and the preliminary data analysis.
- I reviewed the relevant literature.
- I implemented the empirical analysis using heteroscedasticity based identification method by using ivreg2h package in STATA.
- I wrote the draft of the manuscript and was mainly responsible for any revision.
- I presented the article in research seminar to collect suggestions.
- I submitted to the journal and provided additional revisions on reviewing procedure.

Dr. Yabibal M. Walle contributed as followings:

- He provided suggestions on relevant literature.
- He instructed and discussed about the methodology.
- He provided discussions and suggestions on results.
- He provided proof-reading and rewrote some passages.
- He presented the article in a conference to collect suggestions.

Prof. Dr. Helmut Herwartz contributed as followings:

- He developed the idea of suggested variables and methodology.
- He instructed many steps to exploit the data and implementing the analysis.
- He provided proof-reading and reformulation of several passages.

Viet T. Tran, Yabibal M. Walle, and Helmut Herwartz

Local financial development, corruption and firm growth in Vietnam

My contributions to the article are the followings:

• I was in charge of preparation of the data, cleaning and the preliminary data analysis.

• I reviewed the relevant literature.

• I implemented the empirical analysis using heteroscedasticity based identification method by using ivreg2h package in STATA.

• I wrote the draft of the manuscript and was mainly responsible for changes.

• I presented the article in research seminar to collect suggestions.

• I submitted to the journal and correspond to any revision.

Dr. Yabibal M. Walle contributed as followings:

• He developed the research idea, suggested variables and methodology.

• He provided suggestions on relevant literature.

• He instructed and discussed about the methodology.

• He provided discussions and suggestions on results.

• He provided proof-reading and rewrote some passages.

Prof. Dr. Helmut Herwartz contributed as followings:

• He discussed and suggested about the methodology.

• He instructed many steps to exploit the data and implementing the analysis.

• He provided proof-reading and reformulation of several passages.

Viet T. Tran.

Does local financial development matter for the gender gap in promoting Vietnamese firm growth?

I am the single author of this paper. Accordingly, I am responsible for all the empirical

results and written text.

Viet T. Tran, Yabibal M. Walle, and Helmut Herwartz

Local financial development and firm growth: Evidence from Vietnam

My contributions to the article are the followings:

- I was in charge of preparation of the data, cleaning and the preliminary data analysis.
- I reviewed the relevant literature.
- I implemented the empirical analysis using STATA.
- I wrote the draft of the manuscript and was mainly responsible for changes.
- I presented the article in research seminar to collect suggestions.
- I submitted to the journal and correspond to any revision.

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- He provided suggestions on relevant literature.
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- He developed the idea of suggested variables and methodology.
- He instructed many steps to exploit the data and implementing the analysis.
- He provided proof-reading and reformulation of several passages.

Abstract

The following thesis accumulates four self-contained studies which analyse the relationship between local financial development and economic growth in Vietnam. Local financial development is measured at different levels including three distinct levels (district, sub-district and village) for the first study and at the province level for the other three studies. In order to measure local economic growth, we consider household welfare (consumption, income and consumption smoothing) in the first study and firm growth including sales, investment and firm productivity (returns on asset, equity and employee) in three other studies. The identification strategy for the first three studies is based on identification through heteroscedascity and the fourth study is based on cross-sectional data and ordinary least square with accounting for growth opportunities.

The first study *"Local financial development and household welfare in Vietnam: Evidence from a panel survey"* is based on the data from Thailand - Vietnam Social Economics Panel. We employ a household-level panel data for the periods 2007, 2008, 2010 and 2013 covering three provinces and measure local financial development at the district, sub-district and village levels. Our results show that local financial development has a significantly positive effect on household annual income, consumption and consumption smoothing.

The second study *"Local financial development, corruption and firm growth in Vietnam"*further examines the effect of local financial development on Vietnamese economic development. We use a nationally representative panel survey that covers over 40,000 firms for the period 2009-2013. In this study, we examine the effects of province-level financial development and corruption on the performance of Vietnamese firms in terms of the growth rates of sales, investment and sales per worker. We find that province-level financial development promotes firm growth while corruption hinders it. Moreover, financial development and corruption control are complementary to each other in their effects on firm growth. This suggests that while improving financial development or reducing corruption at the province level promotes firm growth, the marginal effect of financial development is stronger when the level of corruption is low, and vice versa.

We also find evidence of the 'too much finance' effect after controlling for the level of corruption. Our results are robust to the use of alternative measures of local financial development.

In the third study *"Does local financial development matter for the gender gap in promoting Vietnamese firm growth?"*, we investigate the differential effects of provincial financial development on the growth of firms owned by female or male entrepreneurs in Vietnam. Using the same data set as in the second study, our results show that local financial development promotes firm growth in terms of the growth rates of sales, investment, return on assets (ROA), and return on equity (ROE). The results also suggest that the gender of the owner affects the growth rates of sales, investment, ROA and ROE. Moreover, the joint effect of local financial development and male ownership is significantly negative through all specifications. This implies that local financial development could help female-owned firms reduce their constraints in promoting firm growth.

The fourth study *"Local financial development and firm growth: Evidence from Vietnam"* re-examines the relationship between local financial development and firm growth based on an identification strategy that uses growth opportunities. We find that local financial development promotes the growth rates of sales, investment and sales per worker while reduces the growth rate of wage per sales of small firms. Our results imply that, in sectors with growth opportunities, firms operating in a financially developed locality grow faster than firms located in provinces with a lower level of financial development. Moreover, the difference in growth rates of firms operating in sectors with stronger growth opportunities and firms in sectors with lower growth opportunities is larger if these firms are located in localities with higher financial development.

Kurzfassung

In der folgenden Arbeit werden vier in sich geschlossene Studien zusammengefasst, die die Beziehung zwischen lokaler finanzieller Entwicklung und wirtschaftlichem Wachstum in Vietnam analysieren. Die lokale finanzielle Entwicklung wird für die erste Studie auf verschiedenen Ebenen gemessen, darunter drei unterschiedliche Ebenen (Bezirk, Unterbezirk und Dorf) für die erste Studie und für die anderen drei Studien auf Provinzebene. Um das lokale Wirtschaftswachstum zu messen, berücksichtigen wir in der ersten Studie das Wohlergehen der Haushalte (Konsum, Einkommen und Konsumglättung) und das Unternehmenswachstum einschließlich Umsatz, Investitionen und Unternehmensproduktivität (Kapitalrendite, Eigenkapital und Mitarbeiter) in drei weiteren Studien. Die Identifizierungsstrategie für die ersten drei Studien basiert auf der Identifizierung durch Heteroskedastizität, und die vierte Studie basiert auf Querschnittsdaten und auf der gewöhnlichen Methode der kleinsten Quadrate unter Berücksichtigung von Wachstumschancen.

Die erste Studie *„Lokale finanzielle Entwicklung und Haushalt in Vietnam: Evidenz aus einer Panel-Umfrage“* basiert auf den Daten des Thailand - Vietnam Social Economics Panel. Wir verwenden Paneldaten auf Haushaltsebene für die Zeiträume 2007, 2008, 2010 und 2013, die sich auf drei Provinzen beziehen und messen die lokale Finanzentwicklung auf Distrikt-, Unterdistrikt- und Dorfebene. Unsere Ergebnisse zeigen, dass sich die lokale Finanzentwicklung deutlich positiv auf das Jahreseinkommen, den Konsum und die Konsumglättung der Haushalte auswirkt.

In der zweiten Studie *„Lokale finanzielle Entwicklung, Korruption und Unternehmenswachstum in Vietnam“* werden die Auswirkungen der lokalen finanziellen Entwicklung auf die vietnamesische Wirtschaftsentwicklung weiter untersucht. Wir verwenden eine national repräsentative Panel-Umfrage, die für den Zeitraum 2009-2013 über 40.000 Unternehmen erfasst. In dieser Studie untersuchen wir die Auswirkungen der finanziellen Entwicklung und der Korruption auf Provinzebene auf die Leistung vietnamesischer Unternehmen in Bezug auf die Wachstumsraten von Umsatz, Investitionen und Verkäufen pro Arbeitnehmer. Wir stellen fest, dass

die finanzielle Entwicklung auf Provinzebene ein festes Wachstum fördert, während Korruption dies behindert. Darüber hinaus ergänzen sich Finanzentwicklung und Korruptionsbekämpfung in ihren Auswirkungen auf das Unternehmenswachstum. Dies deutet darauf hin, dass die Verbesserung der finanziellen Entwicklung oder die Verringerung der Korruption auf Provinzebene zwar ein festes Wachstum fördert, der marginale Effekt der finanziellen Entwicklung jedoch stärker ist, wenn das Korruptionsniveau niedrig ist, und umgekehrt. Wir finden auch Hinweise auf den Effekt ßu viel Finanzennach der Kontrolle des Korruptionsgrades. Unsere Ergebnisse sind robust gegenüber alternativen Maßnahmen der lokalen finanziellen Entwicklung.

In der dritten Studie *„Ist die lokale finanzielle Entwicklung für die Kluft zwischen den Geschlechtern bei der Förderung des Unternehmenswachstums in Vietnam von Bedeutung?“* Untersuchen wir die Auswirkungen der finanziellen Entwicklung der Provinzen und des Gender-Verantwortungsbewusstseins auf das Wachstum von Unternehmen in Vietnam. Unter Verwendung des gleichen Datensatzes wie in der zweiten Studie zeigen unsere Ergebnisse, dass die lokale Finanzentwicklung ein festes Wachstum in Bezug auf die Wachstumsraten von Umsatz, Investitionen, Gesamtkapitalrentabilität (GKR) und Eigenkapitalrentabilität (EKR) fördert. Die Ergebnisse deuten auch auf die unterschiedlichen Geschlechterverhältnisse hin, die sich auf die Wachstumsraten von Umsatz, Investitionen, GKR und EKR auswirken. Darüber hinaus ist die gemeinsame Wirkung von lokaler finanzieller Entwicklung und männlichem Eigentum in allen Spezifikationen erheblich negativ. Dies impliziert, dass die lokale finanzielle Entwicklung dazu beitragen kann, dass Unternehmen in weiblichem Besitz ihre Einschränkungen bei der Förderung des Wachstums festigen.

In der vierten Studie *„Lokale finanzielle Entwicklung und festes Wachstum: Evidenz aus Vietnam“* wird die Beziehung zwischen lokaler finanzieller Entwicklung und festem Wachstum anhand einer Identifizierungsstrategie, die Wachstumschancen nutzt, erneut untersucht. Wir stellen fest, dass die lokale Finanzentwicklung die Wachstumsraten von Umsatz, Investitionen und Verkäufen pro Arbeitnehmer fördert, während sie die Wachstumsrate der Löhne pro Umsatz kleiner Unternehmen verringert. Unsere Ergebnisse deuten darauf hin, dass in Sektoren mit Wachstumschancen

Unternehmen, die in einem finanziell entwickelten Gebiet tätig sind, schneller wachsen als Unternehmen in Provinzen mit geringerer finanzieller Entwicklung. Darüber hinaus ist der Unterschied der Wachstumsraten von Unternehmen, die in Sektoren mit stärkeren Wachstumschancen tätig sind, und Unternehmen in Sektoren mit geringeren Wachstumschancen, größer, wenn diese Unternehmen in Gebieten mit einer höheren finanziellen Entwicklung ansässig sind.

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1 Introduction

During the last three decades, a large number of studies have shown controversial evidence on the role of the financial sector in economic development, either that finance enhances economic development or economic development causes financial growth, at both the macro and micro-level. The pioneering work is from Bagehot (1873) who argues that financial system helps mobilize effectively and efficiently capital that played a critical role in igniting the England's industrialization. Similarly, Schumpeter (1911) asserts that there is a positive influence of the financial sector on the level and growth rate of a country's per capita income. Similar findings are in the works of Gurley and Shaw (1955), Goldsmith (1969), McKinnon (1973), and Shaw (1973). More recently, a large body of empirical studies have documented a positive effect of financial sector on economic development (e.g., King and Levine, 1993; Levine et al., 2000; Herwartz and Walle, 2014b; Arcand et al., 2015). Nobel Laureate Miller (1998) even stresses that "the idea that financial markets contribute to economic growth is a proposition too obvious for serious discussion". However, still a sizable number of studies suggest that either financial development is caused by economic development or there is a weak or fragile relationship between financial development and economic growth (e.g., Ang and McKibbin, 2007; Andersen and Tarp, 2003). Moreover, Robinson (1952) delivers a strong statement that economic development leads to the growth of financial sector in a famous argument "where enterprise leads finance follows". Likewise, Nobel Laureate Robert Lucas (1988) even dismisses the role of finance as an "over-stressed" determinant of economic growth.

While most empirical studies focus on the finance-growth nexus with emphasizing on cross-country heterogeneity in financial sector, fewer works examine the effects of within-country variations in financial sector on economic development. Taking into account the regional heterogeneity in financial development, Jayaratne and Strahan (1996) investigate the relationship between reform in banking sector at the intrastate level and per capita growth in the US in the 1970s and 1980s. They find that improvement in the banking system (e.g, the quality of bank's lending) is accountable for faster growth

of GDP per capita. Focusing at the regional level, Guiso et al. (2004) analyze the effect of regional financial development on firm performance in Italy. Their results show that regional financial development promotes firm growth, enhances competition and supports the entry of new firms. Using the US data from 1900 to 1940, Dehejia and Lleras-Muney (2007) examine the effect of the state-level banking regulation and financial development on the state-level economic growth. They reveal that financial expansion improves mechanization in agriculture and fosters growth in the manufacturing sector.

Exploring at a more aggregate level, Kendall (2012) examines the effects of district-level banking sector development and human capital on district-level economic growth in India. He finds that district-level financial development, which is measured by the percentage of bank credit to net domestic products, has a positive and non-linear impact on district-level economic growth. Similarly, Gloede and Rungruxsirivorn (2013) study the effect of district-level financial development on household welfare in Thailand in 2007. Their results show that district-level financial development promotes productive investment, agricultural revenue and household consumption. Moreover, using the firm-level data in Morocco from 1998 to 2003, Fafchamps and Schündeln (2013) study the effect of financial development, which is measured by bank availability at the commune level, on firm performance. They find that, in sectors with growth opportunities, bank availability robustly facilitates growth rates of small and medium-sized firms, reduces the likelihood of exiting firms and enhances entry of new firms and investments.

However, due to the uniqueness of financial sector across countries, we need more country-specific studies to generalize whether local financial development matters for local economic development. This thesis focuses on Vietnam. There appears to be only a few studies that investigate this relationship in Vietnam. Using panel data over the period 1997 to 2006, Anwar and Nguyen (2011) examine the relationship between financial development and economic growth at the province level in Vietnam. They document that provincial financial development, which is measured by the ratio of credit to the private sector over gross provincial products, promotes provincial economic growth. Similarly, O'Toole and Newman (2017) investigate the effect of provincial financial development on reducing external financial constraints faced by firms.

Employing an extensive firm-level data in Vietnam, they reveal that provincial financial development mitigates the constraints on firms' finance and facilitates investment activity. Our studies are different from Anwar and Nguyen (2011), which investigates the relationship at the province level, in the way that our studies examine the local finance and economic growth in Vietnam at more aggregated levels. In particular, we measure local financial development at different levels and consider local economic growth at household and firm level. Furthermore, while O'Toole and Newman (2017) focus on showing the channel through which local financial development promotes investment (i.e., by alleviating financial constraints), we examine the overall impact of local financial development on firm growth in terms of sales, investment and productivity. The other difference between the present studies and that of O'Toole and Newman (2017) is that while O'Toole and Newman (2017) drop firms with negative growth opportunities, our approach fully accounts for sectoral differences in growth opportunities.

This thesis consists of four self-contained articles that focus on the relationship between local financial development and economic growth in Vietnam. In Chapter 2, we investigate the impact of local financial development on household welfare in Vietnam. The local financial development indicators are measured at three distinct levels (district, sub-district and village) by using regional effects on credit rationing following the method suggested by Guiso et al. (2004). In this study, we exploit the panel data survey from Thailand-Vietnam Social Economic Panel (TVSEP) in 2007, 2008, 2010 and 2013. In Chapters 3, 4 and 5, we further examine the effect of local financial development on economic growth in Vietnam by using different firm growth indicators such as the growth rates of sales, investment, and firm productivity. For these self-contained studies, we use firm-level panel data from Vietnam Enterprise Survey (VES) spanning the period 2009-2013, which includes more than 40,000 firms per year. In order to address the endogeneity issue, which would arise from the fact that economic development would cause local financial development, we employed a recently suggested method of identification through heteroscedasticity in Chapter 2, 3 and 4. In Chapter 5, we follow the strategy suggested by Fisman and Love (2007), Rajan and Zingales (1998) and Fafchamps and Schündeln (2013) to identify the effect of local financial development

on growth by controlling for growth opportunity in each sector. To enhance readability and make each chapter as self-contained article, in each chapter we provide relevant discussion on literature as well as considered models separately. In the following, we will sequentially discuss in details each issue, summarize the main findings and highlight the contributions of this thesis.

The potential reverse causality from economic growth to financial development has been considered as a serious challenge in the finance-growth literature when investigating the impact of financial development on economic growth. Similarly, studies on the effect of local financial development on economic growth at different levels may be suffered from endogeneity issues as local economic growth may also cause the development of local finance. To address the endogeneity in this relationship, the literature proposes to use the dynamic panel data estimators forwarded by Arellano and Bond (1991) and Blundell and Bond (1998). These methods are not appropriate for our study, however, as our panel data covers only few time points. Moreover, a widely-used alternative to identify the causality is the use of external instruments. Nevertheless, finding an appropriate instrument in practice is often challenging due to strict conditions. In this thesis, we employ a recently suggested method of dealing with the endogeneity problem, which has been proposed by Lewbel (2012). This method is built upon earlier works by Rigobon (2003) and Lewbel (2012) suggests an instrumental variable estimation, which is so-called identification through heteroscedasticity. With this strategy, one can generate instruments for endogenous variables by exploiting the correlation between exogenous variables and heteroscedasticity of model disturbances in order to achieve identification without using external instruments. As we have panel data in Chapters 2, 3 and 4, we apply the Stata package *ivreg2h* proposed by Baum and Schaffer (2012).

Chapter 2 corresponds to the article by Tran et al. (2018) as published in the *Journal of Development Studies*. In this chapter, we examine the impact of local financial development on household welfare in three provinces in Vietnam including Thua Thien Hue, Ha Tinh and Dak Lak. Using household level data from the TVSEP in 4 waves in 2007, 2008, 2010 and 2013, we created a local financial development indicator at three distinct levels by using regional effects from a regression of determinants of

the household's credit rationing, as proposed by Guiso et al. (2004). Employing the identification through heteroscedasticity proposed by Lewbel (2012), we investigate the effects of district, sub-district and village-level financial development on household welfare in terms of annual income, consumption and consumption smoothing. In order to get more efficiency by using identification through heteroscedasticity, we additionally use time to travel to reach the district center as an external instrument for local financial development. Therefore, for each three levels of locality, results are reported using the Ordinary Least Squares (equivalent to fixed effects as we use centered data or within estimator on the non-transformed data), the heteroscedasticity-based instruments, as well as IV estimation using both standard and heteroscedasticity-based instruments. Our results reveal that district, sub-district and village-level financial development has a significantly positive impact on household annual income and consumption. Moreover, the results from investigating the effects of local financial development on consumption smoothing suggest that local financial development helps households that suffer from shocks by reducing the effects of shocks on their consumption. In order to check for the relevance of our instruments generated by using identification through heteroscedasticity, we provide the diagnostic tests for the validation of the instruments. The tests for over-identification, under-identification and weak-identification are supportive for the relevance of our instruments. Furthermore, our results are robust to the use of different indicators of local financial development by using the availability of a bank branch at district, sub-district and village levels. Consequently, our results suggest that policy-makers should enhance the access to finance at the local levels as an important policy for promoting household welfare in rural Vietnam.

In Chapter 3, using a rich data set of Vietnamese Enterprise Survey for a panel from 2009 to 2013 and province-level data from Province Competitiveness Index (PCI), we further investigate the effects of local financial development on economic development in Vietnam by accounting for the effect of provincial corruption. Local economic growth is measured at the firm-level and based on the growth rates of investment, sales and sales per worker. Local financial development is measured by using the availability of credit suppliers per 1000 people at the province level and corruption is measured by

the prevalence of informal charges as rated by firms at the province level. Employing the heteroscedasticity-based identification strategy, we examine the first hypothesis that local financial development has a positive impact on firm growth in Vietnam. As firm growth at province level may be affected by corruption, which is known to be a major obstacle for economic growth, we propose the second hypothesis that corruption at province level has a negative impact on firm growth. Moreover, we also examine the joint effects of province-level financial development and corruption on firm growth, which is suggested in previous studies by Ahlin and Pang (2008), and Wang and You (2012). To address the endogeneity that firm growth may affect local financial development and corruption, we sequentially treat local financial development, corruption and the interaction between the two as endogenous variables and using heteroscedasticity based identification method to instrument for them. Furthermore, we account for the nonlinearity of local financial development and corruption in the models to address the potential effects on the interaction term. Our results reveal that province-level financial development enhances firm growth while corruption hinders it. Moreover, financial development and corruption control are complementary to each other in their impacts on firm growth. This suggests that while facilitating province-level financial development or enhancing corruption control at the provincial level promotes firm growth, the marginal effect is stronger when the level of corruption is low, and vice versa. In addition, we provide more evidence to support the 'too much finance' hypothesis proposed by Arcand et al. (2015) at the micro level after controlling the level of corruption. Our results are also robust to the use of alternative measures of province-level financial development.

In Chapter 4, using the same firm-level data set as in Chapter 3, we examine whether local financial development reduces the gap between female-owned and male-owned firms to promote firm growth in terms of the growth rates of sales, investment, return on asset (ROA) and return on equity (ROE). Similar to previous studies, we account for the endogeneity issue, which may arise in investigating the effect of local financial development on firm growth, by using the heteroscedasticity-based identification and complement the generated instruments for local financial development by using external

instruments. The results show that local financial development enhances firm growth, which is in line with previous studies. Moreover, this study significantly suggests that there appears a gap between male-owned and female-owned firms where male-owned firms are better off in terms of increasing the growth rates of investment, sales, ROA, and ROE. However, the interaction term between local financial development and gender is negative through all specifications, which implies that female-owned firms are less constrained by exploiting the local financial development to improve firm growth.

In Chapter 5, we re-examine the finance-growth nexus using the method suggested from Fisman and Love (2007), Rajan and Zingales (1998) and Fafchamps and Schündeln (2013). In their studies, they argue that the appearance of financial suppliers may depend on the firm growth in the region and endogeneity is a concern in estimating the impact of local financial development on firm growth. They claim that growth opportunities might cause both economic growth and financial development. Therefore, we take into account the effect of growth opportunity in order to address the endogeneity issue on the relationship between local finance and growth. Following Fafchamps and Schündeln (2013), we assume that large firms should be less constrained by access to credit (Beck et al., 2005). There are many reasons that large firms are less constrained from credit access from both demand and supply sides. For example, large firms may operate in a broader area and hence they could exploit larger network and availability of more credit suppliers in larger operation area. Obviously, this would help them get more opportunities to access finance than small firms. Furthermore, from supply side, it would be easier for credit suppliers to consider the status of large firms than small firms and they can better evaluate the loan applications of large firms than small firms (Petersen and Rajan, 2002).

Employing this strategy, we measure growth opportunities based on sales growth in each sector of large firms (with more than 50 or 100 employees in the paper), which are considered to be less constrained by financial development. In this chapter, we investigate the joint effect of local financial development and growth opportunity on firm performance. The province-level financial development indicators are measured by using the number of credit suppliers per 1000 capita and per square kilometer. Based

on the fact that, more than 95% of Vietnamese firms are small, we focus on the effect of province-level financial development and growth opportunity on the growth rates of small firms in Vietnam. To measure firm growth, we use the growth rates of firm performance (sales and investment) and firm productivity (sales per worker and wage per sales) for the period of five years from 2009 to 2013. Using ordinary least squared (OLS) and accounting for sector and local effects, our results reveal that province-level financial development promotes the growth rates of sales, investment and sales per worker of small firms, and reduces the growth rate of wage per sales. Moreover, the results imply that in sectors with growth opportunities, firms operating in province with higher financial development grow faster than firms located in provinces with a lower level of financial development. In addition, the difference in growth rates of firms operating in sectors with stronger growth opportunities and firms in sectors with lower growth opportunities is larger if these firms are located in provinces with financial development.

2 Local financial development and household welfare in Vietnam: Evidence from a panel survey

(Published in the Journal of Development Studies, 2018, 54(4), 619-640.)
<https://doi.org/10.1080/00220388.2017.1385772>

Viet T. Tran, Yabibal M. Walle and Helmut Herwartz

Abstract. We examine the impact of local financial development on household welfare in Vietnam. We employ household-level panel data for the periods 2007, 2008, 2010 and 2013 covering three provinces and measure local financial development at the district, sub-district and village levels. To account for potential endogeneity that could emanate from the fact that local economic development could spur local financial development, we employ a recently suggested method of identification through heteroscedasticity. Our results show that local financial development has a significantly positive effect on household annual income, consumption and consumption smoothing.

2.1 Introduction

The role of financial development in economic development has been extensively studied in the last three decades. Notwithstanding the existence of a sizable number of studies suggesting either financial development is caused by economic development and not vice versa (e.g. Ang and McKibbin, 2007), or there is not a clear-cut finance-growth relationship (e.g. Andersen and Tarp, 2003), a large body of empirical literature shows that financial sector development fosters economic development (e.g. Goldsmith, 1969; King and Levine, 1993; Levine et al., 2000; Herwartz and Walle, 2014a and Arcand et al., 2015)[1].

Unlike the macro level, research on the finance-growth nexus at the micro level is relatively scant. Local financial and institutional differences within a country can exert

[1]For more details on the finance-growth debate, see Levine (2005) and Panizza (2014)

an important effect on local economic development. For instance, Petersen and Rajan (2002) document that, even in the US, the distance between small business borrowers and their banks affects the chance to obtain credit. Specifically, over 75% of loans in the US were distributed within a radius of less than 35km (Petersen and Rajan, 2002).

There are a few studies that examine the effects of financial development at the local level on local GDP per capita, industry expansion, firm performance and household welfare. For instance, Guiso et al. (2004) investigate the relationship between firm performance and regional financial development in Italy. They find that local financial development enhances firm growth, promotes competition and favors entry of new firms. Kendall (2012) focuses on financial development and economic growth at the district level in India and reports that banking depth impacts positively on district-level economic growth. Fafchamps and Schündeln (2013) examine the relationship between commune-level financial development and firm performance in Morocco. They find that bank availability at the commune level has a positive impact on the performance of small and medium-sized firms in sectors with growth opportunities. Taking the discussion to the household level, Gloede and Rungruxsirivorn (2013) explore the role of district-level financial development on household welfare in Thailand. The authors document that district-level financial development promotes investment, revenue and consumption of households with demand for external credit.

In this paper, we examine the relationship between local financial development and household welfare in Vietnam, and contribute to the existing empirical literature in four aspects. Firstly, in comparison with other emerging Southeast Asian economies, such as Thailand and Malaysia, research on the link between financial development and economic growth in Vietnam is scant. In particular, as to our knowledge, it is only Phan (2008) who examines the effect of financial development on household welfare in Vietnam. As his focus is not on local financial development, Phan (2008) uses the level and ratio of household financial assets and liabilities to household income to measure financial development at the household level. Given that this measure likely depends on several household characteristics, it does not necessarily reflect local financial development. In this study, we follow the literature on local financial development (e.g. Guiso et al., 2004

and Gloede and Rungruxsirivorn, 2013) to measure local financial development using regional effects from a regression of determinants of the households' access to credit.

Secondly, while the study of Guiso et al. (2004) examines local financial development and firm performance in Italy, where the financial sector is highly integrated with the international financial system, our study focuses on Vietnam, whose financial sector is at a much lower level of integration with the international financial market. As a result, local financial development could likely have more pronounced effects on local economic development in Vietnam than it has in Italy. Hence, our study could shed light on the impact of local financial development on economic growth in relatively closed financial systems. In addition, access to finance is at a much lower level in developing countries than is the case in developed countries. For instance, financial institutions are rarely available in Vietnamese rural areas and at lower administrative jurisdictions, such as sub-districts and villages, while financial institutions are prevalent in the lowest administrative levels in developed countries. Hence, this study could also highlight the role of local financial development on household welfare in economies with a modest degree of access to finance.

Thirdly, this paper relates to the work of Gloede and Rungruxsirivorn (2013) who study the effect of district-level financial development on household welfare in Thailand by means of cross-sectional data collected in 2007. Unlike Gloede and Rungruxsirivorn (2013), however, we exploit panel data collected in 2007, 2008, 2010 and 2013, and measure local financial development at three distinct levels of administrative hierarchies: district, sub-district and village levels.

Fourthly, it is plausible to think that banks open new branches in localities with richer households, making local financial development an endogenous variable in our household welfare model. We address this endogeneity problem by means of heteroscedasticity-based instrumental variable (IV) estimation (Lewbel, 2012). With this method, we exploit the correlation between exogenous variables and variances of model disturbances in order to achieve identification without imposing any exclusion restrictions.

Our results show that local financial development has a significantly positive impact on household annual income and consumption. These results are robust to the use

of the availability of a bank branch as an alternative measure of local financial development. Moreover, households with demand for credit consume more in financially more developed localities, perhaps reflecting the role of local financial development in consumption smoothing. In relation to this, we also find that local financial development significantly reduces the probability that a household cuts its consumption in the aftermath of a negative income shock.

Section 2.2 provides a brief overview of the Vietnamese financial sector. We describe the data and discuss ways of measuring local financial development in Section 2.3. In Section 2.4, we outline the methodology of identification through heteroscedasticity. Estimation results on the relationship between local financial development and household welfare are analysed in Section 2.5. Section 2.6 concludes. Results using three further indicators of local financial development are documented in the Appendix 2.7.

2.2 The Vietnamese financial sector

Currently, the Vietnamese financial system is characterized by a large banking sector but relatively smaller non-bank financial institutions and a securities market. The financial system is large for a low middle-income country with total assets of nearly 200% of GDP at the end of 2011 (World Bank, 2014). The banking sector in Vietnam comprises four state-owned commercial banks (SOCBs)[2], 33 joint stock commercial banks (JSCBs), five joint venture banks and five wholly foreign-owned banks (Tran et al., 2015). The total asset of the banking sector is 183% of GDP and accounts for 92% of financial institutions' assets (World Bank, 2014). The significant increase in private, foreign and mixed-ownership banks has enhanced financial services. Among SOCBs, Agribank has the largest operating networks with around 2,400 branches and units nationwide. The Industrial and Commercial Bank of Vietnam (Vietinbank), the Bank for Investment and Development of Vietnam (BIDV), and the Bank of Foreign Trade of Vietnam (VCB)

[2]Formerly, there were five SOCBs including Vietnam Bank for Agriculture and Rural Development (Agribank), the Industrial and Commercial Bank (Vietinbank), the Bank of Foreign Trade of Vietnam (VCB), the Bank for Investment and Development of Vietnam (BIDV) and Housing Bank of Mekong Delta (MHB, established in 1997 and merged to BIDV in May 2015). However, the new corporate law which came into effect in January 2015 defines SOCBs as commercial banks that are 100% owned by the SBV, thereby making Agribank the only SOCB in Vietnam.

have, respectively, about 1123, 725 and 328 branches and units (Tran et al., 2015).

Vietnam's equity market has grown in recent years, but capitalization is relatively small at about 19% of GDP in 2011 (World Bank, 2014). Established in 2000 and 2005 respectively, the two stock exchanges, the Ho Chi Minh Stock Exchange (HSX) and Hanoi Stock Exchange (HNX) have more than 700 listed companies by the middle of 2016. About one-third of the listed companies are state-owned with a major proportion of capital belonging to the state-owned enterprises.

Among non-bank financial institutions, finance companies are the largest, accounting for 3% of all financial institutions' asset and 6% of GDP. Insurance companies account for 4% of GDP while the mutual funds constitute less than 1% of GDP (World Bank, 2014).

2.3 Data

2.3.1 Data Source

The dataset for this study originates from the project "Impact of Shocks on the Vulnerability to Poverty: Consequences for Development of Emerging Southeast Asian Economies" (DFG FOR 756). The surveys were carried out in Vietnam and Thailand in 2007, 2008, 2010 and 2013. Three of the poorest provinces in Vietnam were chosen for the survey: Ha Tinh, Thua Thien Hue and Dak Lak.[3] The surveyed areas are shown in Figure 2.1.

Within the three provinces, 32 districts were randomly selected, and within these districts, 110 sub-districts were chosen based on population size. Subsequently, two villages were randomly selected in each sub-district. Covering 10 randomly selected households in each of the 220 villages, the surveys finally consist of about 2197 households.

The surveys contain detailed information on household characteristics including demographics, assets, income, expenditure, borrowing, lending, savings, household

[3]Vietnam's per capita GDP in PPP was about 5300 USD in 2013 (World Bank, 2016), making it a lower middle income economy. The provinces Ha Tinh and Thua Thien Hue are located in central Vietnam with per capita income about 1800 USD and 1400 USD, respectively. Located in the highlands of Vietnam, Daklak has a per capita income of about 1755 USD.

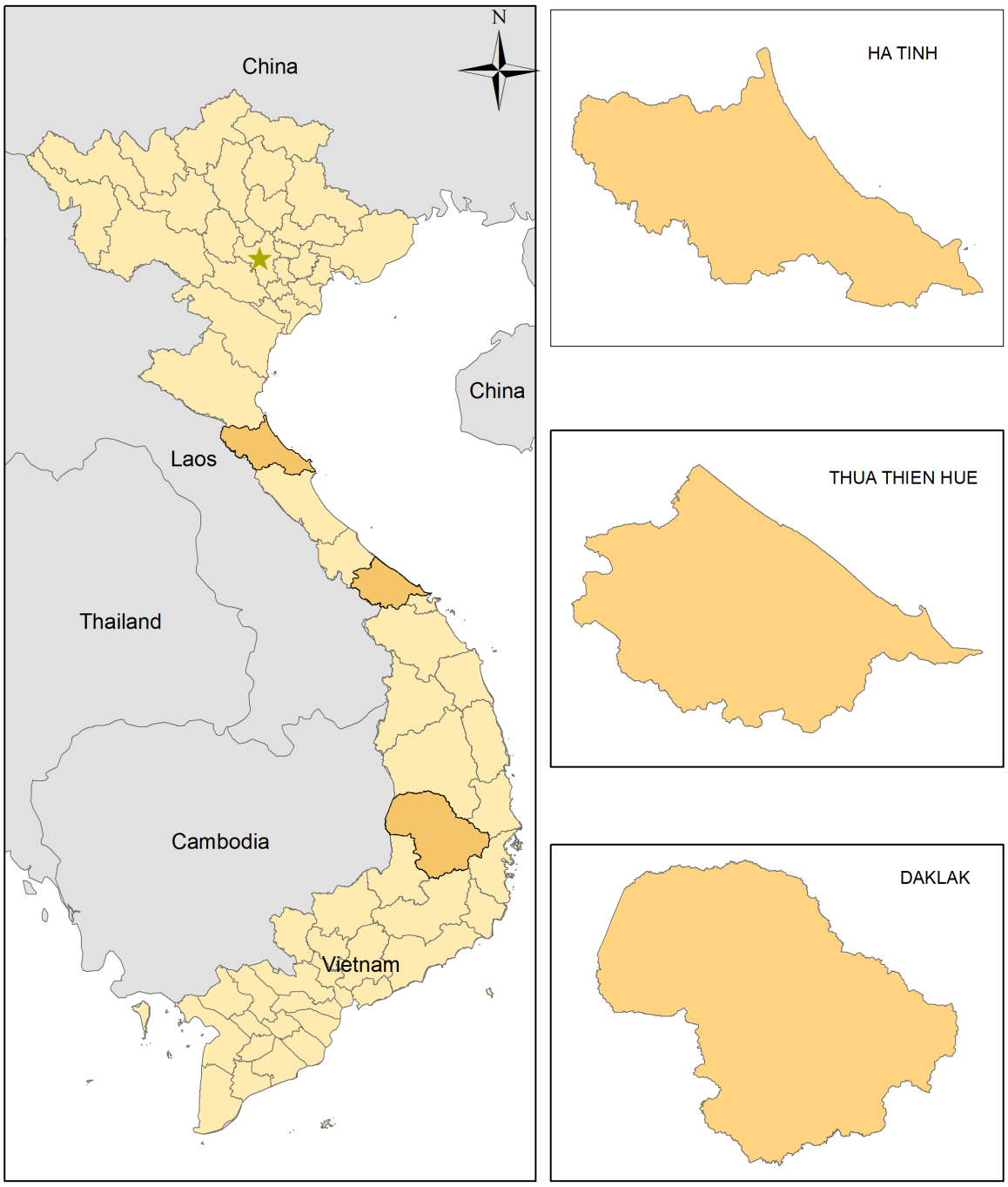

Figure 2.1: Surveyed Vietnamese provinces.

Vietnam is located in Southeast Asia. It has 61 provinces and about 91 million people by the end of 2015. The total area is about 333,000 square kilometers. The capital of Vietnam is Hanoi, which is indicated by the ($\star$) in the map. The three surveyed provinces are among the poorest provinces in Vietnam.

business, occupation, agricultural activities, off-farm activities, education and health status in each year of the survey. Moreover, regional characteristics, such as the number of households and banks in the villages, are also provided.

2.3.2 Summary statistics

Table 2.1 provides descriptive statistics for the variables in our sample. Panel A describes our indicators for household welfare, each measured in 2005 US dollars (USD) using purchasing power parity (PPP) rates. Specifically, annual household income and consumption are about 6100 USD and 4946 USD, respectively. Moreover, about 74.61 per cent of households report that they have to cut consumption when they suffer from negative income shocks such as illness, flooding and theft.

Panel B of Table 2.1 documents details on household characteristics. With households having an average of four members, the average per capita annual income is about 1,655 USD. Almost all of the households (91%) are involved in crop production. The average size of agricultural production land is about 0.5 hectares. The rate of late repayment and default is about 15.3 per cent. About 72.2 per cent of households have applied for credit, of which about 11.3 per cent faced credit rationing in the form of either full rejection or only partial acceptance of their credit applications.

The panel C of Table 2.1 provides information on household heads. For instance, about 84 per cent of the households are headed by males. The average age of household heads is 50 years, and 81 per cent of them are married. About 75 per cent of them belong to the majority ethnic group (Kinh people). Regarding occupations, while about 65 per cent of household heads are farmers, about 11 per cent of them are government officials and business owners. The rate of literacy of household heads (who have ever been to school) is about 88 per cent, while about 33.5 per cent of them suffered from serious disease at the time of the survey. Figure 2.2 depicts the detailed main occupations of the household heads in 2007 and 2013. In 2007, about 71.8 per cent of household heads were involved in agricultural production such as agricultural cultivation, fishing, hunting, and collecting. The remaining 7.2 per cent and 3.9 per cent of household heads are business owners and government officials, respectively. The percentage of household

Table 2.1: Summary statistics

Variable description	Observations	Mean	Std.Dev	Min	Max
Panel A: Household Welfare (USD by PPP in 2005)					
HH income	8377	6100	9026	-158191	312993
HH consumption	8002	4946	3648	243	87503
HH members reducing consumption due to shocks	13532	0.746	0.435	0	1
Panel B: Household Characteristics					
Per capita income	8375	1655	2672	-39548	78248
HH size	8451	4.231	1.766	0	14
Crop production	8360	0.911	0.285	0	1
Production area (ha)	7740	0.504	2.006	0	119.221
Late repayment and default	8788	0.153	0.659	0	13
Credit demand	8788	0.722	0.448	0	1
Credit rationing	6344	0.113	0.317	0	1
Panel C: Household head Characteristics					
Male	8377	0.841	0.365	0	1
Age	8376	50.269	13.951	0	100
Married	8788	0.810	0.392	0	1
Kinh People	8788	0.753	0.432	0	1
Farmer	8788	0.654	0.476	0	1
Government official and businessmen	8788	0.109	0.312	0	1
Literate	8139	0.884	0.320	0	1
Disease	8255	0.335	0.472	0	1
Panel D: Local Characteristics					
Number of banks in district	128	1.617	1.469	0	4
Number of banks in sub-district	440	0.430	0.763	0	4
Number of banks in village	844	0.058	0.280	0	3
Bank availability in district	128	0.656	0.477	0	1
Bank availability in sub-district	440	0.300	0.459	0	1
Bank availability in village	880	0.047	0.211	0	1
Average hour from district to center	128	0.511	0.312	0.133	2.479
Average hour from sub-district to center	440	0.511	0.419	0.059	4.667
Average hour from village to center	875	0.511	0.487	0.017	9.167
Library availability in district	128	0.141	0.349	0	1
Library availability in sub-district	440	0.045	0.209	0	1
Library availability in village	880	0.023	0.149	0	1
Nursery availability in district	128	0.641	0.482	0	1
Nursery availability in sub-district	440	0.441	0.497	0	1
Nursery availability in village	880	0.290	0.454	0	1

Notes: Mean, Std.Dev, Min and Max represent mean, standard deviation, minimum and maximum, respectively.

heads involved in agriculture decreased from 71.83 per cent in 2007 to 57.5 per cent in 2013. This shows that there is a shift in occupation of household heads in these provinces from agriculture to other sectors.

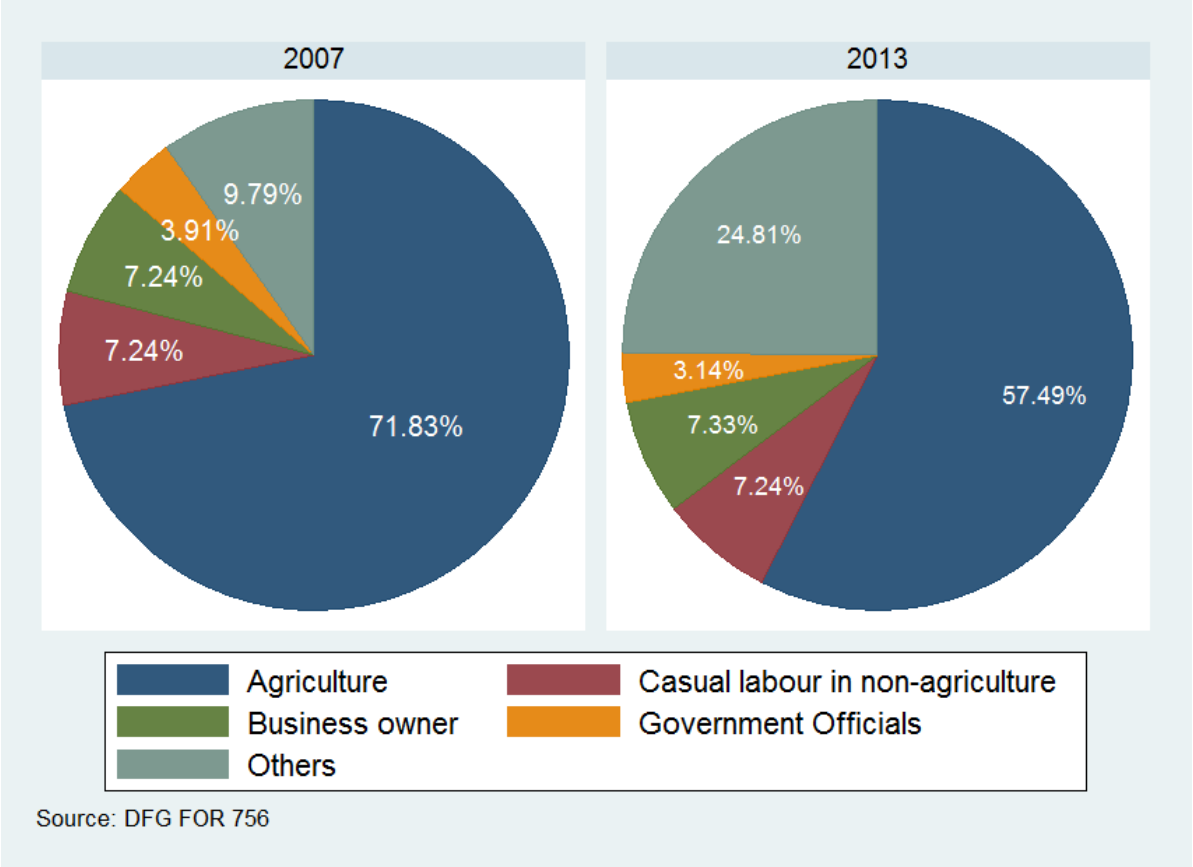

Figure 2.2: Main occupation of household heads

Panel D of Table 2.1 displays certain local characteristics. In particular, each district, sub-district and village has respectively 1.6, 0.4 and 0.06 bank branches on average. Moreover, 65.6 per cent of the districts, 30 per cent of the sub-districts and 4.7 per cent of the villages have at least one bank branch. In the survey, village heads were asked how long it takes to travel from the village to the district center. Taking the average across villages in the sub-districts and districts, we find that it takes nearly the same average time of about half an hour to reach from districts, sub-districts and villages to the district center. However, the maximum time needed to reach the district center is 2.5, 4.7 and 9.2 hours from a district, sub-district and village, respectively. With regard

to local economic development, there is a library (nursery) in about 14.1 per cent, 4.5 per cent and 2.3 per cent (64.1%, 44.1% and 29%) of districts, sub-districts and villages, respectively.

2.3.3 Local financial development indicators

There are a few ways of measuring local financial development suggested in existing studies on the local finance-growth nexus. For example, Guiso et al. (2004) define a region as financially more developed if, ceteris paribus, it is easier for a borrower to obtain credit in this region compared with other regions. In other words, more denials of credit applications indicate a less developed financial environment. For the case of Italy, they consider the regional effects from a model of a household's probability of being shut off from the credit market as a measure of local financial (under)development. Gloede and Rungruxsirivorn (2013) apply the same method to quantify financial development in districts of Thailand.

In this paper, we measure local financial development following Guiso et al. (2004) and Gloede and Rungruxsirivorn (2013). The baseline indicator is based on credit rationing (CR). We consider a household to have been subjected to credit rationing if, at a given year, its application for credit is either rejected or only partially accepted. In the survey, respondents were asked which financial suppliers rejected their credit application or allowed them partially. As shown in Table 2.2, the financial suppliers are diverse, ranging from governmental banks to informal money lenders. It is worth noting here that, among the households which reported to have been credit-rationed, about 30 per cent of them were credit-rationed by informal credit suppliers such as money lenders and families in their localities. It is well-known that informal financial suppliers, such as moneylenders, and traders, often obtain credit from banks to provide informal credit to borrowers (e.g., Madestam, 2014). Thus, although being credit-rationed by such informal lenders does not directly imply a lower level of financial development in those localities, it indirectly indicates the shortage of financial resources in the formal financial sector in those localities.[4]

[4]Our main results reported in this paper do not change when we narrow our definition of being credit-

Table 2.2: Financial suppliers from which households were credit-rationed

Institutions for applying credit	Frequency	Percentage
Bank for social policy	144	18.65
Bank for agriculture and rural development	255	33.03
Credit organization (e.g. PCF)	13	1.68
Socio-political organizations	55	7.12
Business partner/trader	28	3.63
Money lender	136	17.62
Commercial bank	8	1.04
Family in village	52	6.74
Family outside village (same province)	14	1.81
Family from other province	3	0.39
Friends in village	53	6.87
Friends outside village (same province)	6	0.78
Credit group (Ho/Hui or Phuong)	1	0.13
Government Housing Bank	2	0.26
Others	2	0.26
Total	772	100

A region is said to have a relatively more developed financial environment if the likelihood of rejection or not getting the full amount of a credit application is lower. However, unlike previous studies, we measure local financial development at three distinct levels: district, sub-district and village. For this purpose, we conduct year-specific regressions[5] of the following linear probability model:

$$CR_{hit} = \boldsymbol{w}'_{hit}\boldsymbol{\alpha}_t + V_i\beta_{it} + \nu_{hit}, \tag{2.1}$$

where CR_{hit} is a dummy variable reflecting credit rationing of household h at locality i in time t. It equals to 1 if a household's credit application is rejected or only partially accepted and equals to 0 otherwise. The vector $\boldsymbol{w}_{hit}$ stacks several household, household head and local characteristics while V_i represents a dummy variable for locality i. The

rationed to include only those households which were credit-rationed by formal financial suppliers (i.e., excluding households which were credit-rationed by money lenders, families and friends). These results are provided in the online Supplementary Materials to this paper.

[5]Alternatively, we perform a pooled regression of (2.1) including year dummies, and construct the local financial development indicator as a function of local and year dummies. As results documented in the online Supplementary Material to this paper show, using this indicator yields qualitatively similar results on the impact of local financial development on household welfare.

error term is denoted by ν_{hit}.

According to (1), credit rationing CR_{hit} could be influenced by distinct household and local characteristics. We include several household characteristics, such as income, number of household members, land use ownership, credit history and occupation, which could affect the likelihood that a household gets credit. For example, if a household has a bad credit history, such as default or late repayments, its loan application would more likely be rejected by credit suppliers. Furthermore, we add local features, such as the number of households in the village and distance to the district center, which could affect the household's probability to obtain credit. Availability of a library, nursery and firms is considered to account for local economic development. We use three distinct linear probability model estimations for each year and take the estimates for the village, sub-district and district dummy variables to create three financial development indicators at the respective levels.

Table 2.3: Determinants of credit rationing

	District				Village			
	2007	2008	2010	2013	2007	2008	2010	2013
Late repayment and default	0.086***	0.022*	0.020**	0.051***	0.080***	0.020	0.025**	0.045***
	(0.013)	(0.012)	(0.010)	(0.010)	(0.014)	(0.013)	(0.011)	(0.011)
HH income	−0.012	−0.025***	−0.011	−0.023***	−0.011	−0.028***	−0.002	−0.023***
	(0.010)	(0.007)	(0.008)	(0.008)	(0.012)	(0.008)	(0.009)	(0.009)
Production area (ha)	0.005	−0.002	−0.002	0.002	0.071	−0.002	−0.002	0.004
	(0.069)	(0.008)	(0.004)	(0.004)	(0.080)	(0.008)	(0.005)	(0.005)
Male	0.008	−0.017	0.038	−0.045	0.020	−0.034	0.038	−0.049
	(0.048)	(0.028)	(0.032)	(0.033)	(0.053)	(0.030)	(0.035)	(0.037)
Age	−0.001	−0.000	0.000	0.000	−0.001	−0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Disease	0.017	0.031**	0.023	−0.003	0.028	0.031*	0.019	−0.002
	(0.024)	(0.015)	(0.016)	(0.016)	(0.027)	(0.017)	(0.017)	(0.018)
Literate	−0.021	0.000	−0.001	0.027	−0.033	0.006	0.019	0.033
	(0.038)	(0.024)	(0.026)	(0.026)	(0.042)	(0.026)	(0.029)	(0.029)
Married	−0.048	−0.004	−0.001	0.039	−0.041	0.025	−0.011	0.050
	(0.052)	(0.030)	(0.037)	(0.037)	(0.056)	(0.033)	(0.041)	(0.041)
Kinh people	0.064	0.010	−0.017	0.009	0.041	0.022	−0.032	0.030
	(0.039)	(0.024)	(0.026)	(0.025)	(0.087)	(0.050)	(0.055)	(0.052)
HH nucleus size	−0.011	−0.000	−0.004	0.011**	−0.012	0.000	−0.007	0.009*
	(0.007)	(0.004)	(0.005)	(0.005)	(0.008)	(0.005)	(0.005)	(0.005)
Farmer	0.026	0.031*	−0.007	0.008	−0.009	0.029	−0.018	0.005
	(0.033)	(0.019)	(0.021)	(0.020)	(0.037)	(0.020)	(0.023)	(0.023)
Government officials	−0.061	0.042	0.004	0.043	−0.096*	0.034	−0.020	0.038
and businessmen	(0.050)	(0.027)	(0.031)	(0.031)	(0.054)	(0.029)	(0.034)	(0.035)
Local dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1341	1480	1288	1248	1341	1480	1288	1248
Adjusted R-squared	0.292	0.093	0.086	0.102	0.293	0.095	0.086	0.081

Notes: the values provided in parentheses are estimated robust standard errors. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively.

The coefficients β_{it} in (2.1) measure the relative degree of financial underdevelopment in locality i in year t. Higher coefficient estimates $\hat{\beta}_{it}$ indicate a higher probability of rejection for loan applications in locality i in year t, and hence they imply that the respective locality is characterized by a lower level of local financial development.

The results from estimating the model in (2.1) at the district and village levels are documented in Table A3.1.[6] It can be seen that most household, household head and local characteristics are correlated with credit constraints with the expected signs. However, only a few variables have a statistically significant impact on credit rationing. In particular, similar to the results in Gloede and Rungruxsirivorn (2013), a bad credit history negatively affects the probability that a household could get a loan. This result is consistent at the village, sub-district and district levels. As expected, higher household income reduces the probability of credit rationing while household head's illness increases it. Moreover, credit suppliers are more likely to extend credit to government officials and businessmen than to farmers. Controlling for household income, larger household nucleus size reduces a household's credit worthiness and, hence, increases its probability of being credit-rationed.

As the estimates for local dummies $\hat{\beta}_{it}$ represent financial underdevelopment, we follow Guiso et al. (2004) to transform them to a measure of local financial development as

$$fd_{it}^{(\bullet)} = \left(1 - \frac{\hat{\beta}_{it}}{\hat{\beta}_{max}}\right), \tag{2.2}$$

where $\hat{\beta}_{max}$ is the maximum of $\hat{\boldsymbol{\beta}} = (\hat{\beta}_{11}, ..., \hat{\beta}_{N^{(\bullet)}T})$, with $i = 1, ..., N^{(\bullet)}$, $t = 1, ..., T$ and '$\bullet$' refers to the level of jurisdiction: village v, sub-district s or district d, i.e $\bullet \in \{v, s, d\}$.[7]

Table A3.2 documents summary statistics for the local financial development indicators. The indicator at the district level, $fd_{it}^{(d)}$ has a mean of 0.623 and ranges

[6]Corresponding results at the sub-district level are quantitatively similar to district and village level results and are available upon request.

[7]We use the superscript $(\bullet)$ in $N^{(\bullet)}$ to indicate that the total number of local units depends on the level of aggregation with $N^{(d)} < N^{(s)} < N^{(v)}$.

from 0 to 0.905. At the sub-district level, the indicator $fd_{it}^{(s)}$ has a mean of 0.758 and takes values from 0 to 0.997. The village level indicator $fd_{it}^{(v)}$ has a mean value of 0.813 and shows the largest variation, ranging from 0 to 1.040. Moreover, the correlations between district, sub-district and village level financial development indicators are high with a minimum correlation of 0.748.

Table 2.4: Local financial development indicators

Panel A: Summary Statistics

Variable	Level	Obs.	Mean	Std.Dev.	Min	Max
$fd_{it}^{(d)}$	district	8788	0.623	0.189	0	0.905
$fd_{it}^{(s)}$	sub-district	8788	0.758	0.170	0	0.997
$fd_{it}^{(v)}$	village	8788	0.813	0.162	0	1.040
$bank_{it}^{(d)}$	district	8788	0.685	0.465	0	1
$bank_{it}^{(s)}$	sub-district	8788	0.274	0.446	0	1
$bank_{it}^{(v)}$	village	8788	0.048	0.215	0	1

Panel B: Correlation between local financial development indicators

	$fd_{it}^{(d)}$	$fd_{it}^{(s)}$	$fd_{it}^{(v)}$	$bank_{it}^{(d)}$	$bank_{it}^{(s)}$	$bank_{it}^{(v)}$
$fd_{it}^{(d)}$	1					
$fd_{it}^{(s)}$	0.867*	1				
$fd_{it}^{(v)}$	0.748*	0.862*	1			
$bank_{it}^{(d)}$	0.452*	0.428*	0.388*	1		
$bank_{it}^{(s)}$	0.271*	0.252*	0.219*	0.417*	1	
$bank_{it}^{(v)}$	0.081*	0.063*	0.049*	0.153*	0.367*	1

Notes: significance at the 1 per cent is indicated by *.

To check for the robustness of our results to the use of competing local financial development indicators, we use the availability of bank branches at the district, sub-district and village level $bank_{it}^{(\bullet)}$ as alternative indicators of local financial development (Fafchamps and Schündeln, 2013). The dummy variables $bank_{it}^{(d)}$, $bank_{it}^{(s)}$ and $bank_{it}^{(v)}$ take on a value of one if there is at least one bank branch at the district, sub-district and village levels, respectively, and zero otherwise. As documented by Petersen and Rajan (2002), and argued by Guiso et al. (2004) and Fafchamps and Schündeln (2013), the availability of a credit supplier at a local area could affect the probability that a borrower

could access credit. As shown in Panel A of Table A3.2, the ratio of districts, sub-district and villages with at least one bank branch is about 0.685, 0.274, and 0.050, respectively. Panel B of Table A3.2 documents the mostly positive and significant correlation between our main local financial development indicators $fd_{it}^{(\bullet)}$ and the alternative measures $bank_{it}^{(\bullet)}$. Most importantly, the correlation between the two measures is the strongest at the district level with a correlation coefficient of 0.452, and decreases to 0.252 and 0.049 at the sub-district and village levels.

2.4 Identification through heteroscedasticity

In order to identify the effect of local financial development on household welfare, we estimate the following model:

$$Y_{hit} = \delta + \boldsymbol{x}'_{hit}\boldsymbol{\theta} + FD_{it}\gamma + \epsilon_{hit}, \tag{2.3}$$

where Y_{hit} represents a measure of household welfare (income or consumption) of household h at locality i in time t. FD_{it} denotes local financial development (as measured by $fd_{it}^{(\bullet)}$ or $bank_{it}^{(\bullet)}$) in locality i in time t at the district, sub-district and village levels, i.e., $\bullet \in \{v,\ s,\ d\}$. Other household and local characteristics are stacked in a vector of explanatory variables, $\boldsymbol{x}_{hit}$.

In the finance-growth literature, potential reverse causality from economic growth to financial development has been a serious challenge in consistently estimating the impact of financial development on economic growth. Similarly, studies on the impact of local financial development on household welfare may suffer from endogeneity as increases in household welfare may also cause improvements in financial development at the local level. To address this problem, the literature heavily relies on the use of dynamic panel data estimators forwarded by Arellano and Bond (1991) and Blundell and Bond (1998). These methods are not appropriate for our study, however, as our panel data covers only four time points. A widely-used alternative to identify causal relationships is the use of external instruments. Finding appropriate instruments is often difficult in practice, since such an instrument should affect household welfare through its effect on local financial

development while it should not be affected by household welfare. Institutional factors, such as legal origin, have been widely used as instruments in macro-level finance-growth studies (e.g. Levine et al. (2000)). However, these instruments are not appropriate for this study as all households live within one country where there are few institutional differences among localities.

Another way of dealing with the endogeneity problems has been recently proposed by Lewbel (2012). Building upon earlier works, e.g., Rigobon (2003), Lewbel (2012) suggests an instrumental variable estimation called identification through heteroscedasticity. With this method, one can exploit the correlation between exogenous variables and heteroscedasticity of model disturbances in order to achieve identification without imposing any exclusion restrictions. This method will be our main identification strategy, as it does not rely on having a medium-sized time series dimension. In the following, we briefly describe this procedure.

Assume that as a complement to (2.3) the reverse effect of household welfare on local financial development could be modelled as

$$FD_{it} = \pi + \boldsymbol{x}'_{hit}\boldsymbol{\phi} + Y_{hit}\lambda + \xi_{hit}, \tag{2.4}$$

where the variables FD_{it}, $\boldsymbol{x}_{hit}$ and Y_{hit} are as defined in (2.3) and ξ_{hit} is the error term. Besides the usual regression assumptions that the structural error terms in models (2.3) and (2.4) are independent from each other and from the explanatory variables $\boldsymbol{x}_{hit}$, the heteroscedasticity-based identification strategy additionally assumes the existence of heteroscedasticity in ξ_{hit} (and hence FD_{it}). Specifically, while the usual assumptions are

$$\mathrm{Cov}(\boldsymbol{x}'_{hit}, \epsilon_{hit}) = \mathrm{Cov}(\boldsymbol{x}'_{hit}, \xi_{hit}) = \mathrm{Cov}(\boldsymbol{x}'_{hit}, \epsilon_{hit}\xi_{hit}) = 0,$$

it is now additionally assumed that

$$\mathrm{Cov}(\boldsymbol{x}'_{hit}, \xi^2_{hit}) \neq 0.$$

Lewbel (2012) suggests using $[\boldsymbol{x}'_{hit} - \mathrm{E}(\boldsymbol{x}'_{hit})]\hat{\xi}_{hit}$ as an instrument for FD_{it} in

estimating (2.3), where $\hat{\xi}_{hit}$ is the predicted residuals obtained by estimating equation (2.4) excluding Y_{hit} on the right-hand side. This is a promising instrument because $[\boldsymbol{x}'_{hit} - \mathrm{E}(\boldsymbol{x}'_{hit})]\hat{\xi}_{hit}$ is uncorrelated with ϵ_{hit} as it is already assumed that $\mathrm{Cov}(\boldsymbol{x}'_{hit}, \epsilon_{hit}\xi_{hit}) = 0$ and it is correlated with FD_{it} through ξ_{hit}. Moreover, the condition $\mathrm{Cov}(\boldsymbol{x}'_{hit}, \xi^2_{hit}) \neq 0$ need to hold only for a subset $\boldsymbol{z}_{hit}$ of the vector $\boldsymbol{x}_{hit}$.

As we have panel data, we follow Baum and Schaffer (2012) to eliminate household-specific fixed effects by means of the within transformation and apply the estimation method of Lewbel (2012) discussed above on the transformed data. Lewbel (2012) argues that using standard (external) instruments improves efficiency of heteroscedasticity based IV estimation. Hence, while heteroscedasticity-based identification remains our main estimation strategy, we additionally use time to travel to reach the district center as an instrument for local financial development. We apply the Stata package *ivreg2h* by Baum and Schaffer (2012), which reports estimation results using generated (heteroscedasticity-based) instruments as well as a combination of both standard and generated instruments. Each estimation result also includes diagnostic tests for underidentification, overidentification and weak identification.[8]

2.5 Empirical results

In this section, we first document and discuss estimation results on the impact of local financial development on household welfare as measured by household annual income. Using consumption and consumption smoothing as alternative measures of welfare, we subsequently examine the impact of local financial development on household consumption and reduction in household consumption due to negative income shocks.

2.5.1 Financial development and household income

In our data set household annual income is defined as the total net income from all activities of the household. The sources of household income include remittances, house and homestead, land rent, crop production, livestock and aquaculture, hunting, off-

[8]See notes to Table 2.5 for details on these tests.

farm employment, non-farm self-employment, lending, savings, transfer and indemnity payments. Income is then defined as the amount of money left after deducting all costs associated with these activities. As a result, it could be considered as disposable income and could serve as a good indicator of household welfare.

Table 2.5 documents estimation results on the determinants of household income. Our variables of interest are local financial development and the interaction term between local financial development and household demand for credit. Credit demand of a household is a dummy variable which takes on a value of one if the household has applied for credit, and zero otherwise. The coefficient on local financial development indicates the impact of local financial development for household income regardless of the household's demand for credit. This should reflect the importance for household welfare of the functions of the financial system such as saving and facilitating the exchange of goods and services. The interaction term, however, is meant to uncover the effects of local financial development on households who actually take advantage of the lending services of financial institutions.

For each of the three levels of locality, results are reported for specifications using the Ordinary Least Squares estimation (OLS),[9] the heteroscedasticity-based IV estimation (hetero IV), as well as for IV estimation using both standard and heteroscedasticity-based instruments (all IV). Results show that, in all of the nine specifications, local financial development has a significantly positive impact on household annual income. These results reveal the important role of local financial development in promoting household welfare in Vietnam. It is worth noting here that our results do not rule out the possibility that household annual income could affect local financial development. Nevertheless, the use of IV estimation allows us to attribute the positive relationship between local financial development and household annual income at least partly to the exogenous component of local financial development (Levine et al., 2000).

Table 2.5 also shows that credit demand is negatively associated with household income. This negative coefficient likely reflects the fact that households who applied for

[9]As we work on within transformed data, our use of OLS is equivalent to applying a fixed effects (within) estimator on the non-transformed data.

Table 2.5: The effect of local financial development on household income

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.497***	1.111***	0.619***	0.559***	1.030***	1.020***	0.532***	0.522**	0.586**
	(0.139)	(0.203)	(0.154)	(0.128)	(0.194)	(0.194)	(0.131)	(0.239)	(0.236)
Credit demand	−0.063	−0.066***	−0.067***	−0.061	−0.050**	−0.042*	−0.060	−0.041**	−0.041**
	(0.042)	(0.018)	(0.020)	(0.042)	(0.023)	(0.022)	(0.043)	(0.020)	(0.020)
FD*Credit demand	0.008	−0.096	−0.037	−0.072	−0.144*	−0.151*	0.098	0.066	0.066
	(0.079)	(0.059)	(0.056)	(0.094)	(0.078)	(0.078)	(0.103)	(0.085)	(0.081)
Production area (ha)	0.006	0.000	0.005**	0.006	0.000	−0.000	0.007	0.005***	0.005***
	(0.004)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)
Male	−0.082	−0.097	−0.107	−0.108	−0.093	−0.063	−0.096	−0.168	−0.100
	(0.240)	(0.167)	(0.185)	(0.243)	(0.173)	(0.171)	(0.258)	(0.198)	(0.182)
Age	0.057***	0.039***	0.055***	0.059***	0.048***	0.047***	0.063***	0.058***	0.056***
	(0.009)	(0.007)	(0.006)	(0.009)	(0.007)	(0.007)	(0.009)	(0.008)	(0.008)
Disease	0.027	0.028	0.012	0.028	0.011	0.010	0.029	0.008	0.006
	(0.037)	(0.027)	(0.025)	(0.038)	(0.023)	(0.023)	(0.038)	(0.024)	(0.023)
Literate	0.172**	0.207***	0.214***	0.170**	0.214***	0.205***	0.164**	0.144***	0.147***
	(0.073)	(0.060)	(0.057)	(0.072)	(0.057)	(0.057)	(0.071)	(0.055)	(0.043)
Married	−0.092	−0.012	−0.046	−0.097	−0.038	−0.063*	−0.099	−0.024	−0.026
	(0.069)	(0.046)	(0.043)	(0.068)	(0.038)	(0.033)	(0.069)	(0.034)	(0.030)
Kinh people	0.064	−0.000	0.018	0.066	0.077	0.073	0.059	0.046	0.050
	(0.089)	(0.062)	(0.051)	(0.092)	(0.074)	(0.074)	(0.093)	(0.075)	(0.074)
HH nucleus size	0.063***	0.070***	0.069***	0.061***	0.069***	0.073***	0.061***	0.071***	0.072***
	(0.011)	(0.008)	(0.008)	(0.011)	(0.009)	(0.008)	(0.011)	(0.009)	(0.008)
Farmer	−0.074	−0.051*	−0.050*	−0.067	−0.055**	−0.044*	−0.067	−0.064**	−0.069**
	(0.045)	(0.030)	(0.030)	(0.046)	(0.027)	(0.026)	(0.046)	(0.031)	(0.032)
Government officials	0.281***	0.236***	0.244***	0.284***	0.233***	0.251***	0.284***	0.251***	0.243***
and businessmen	(0.060)	(0.050)	(0.050)	(0.057)	(0.042)	(0.039)	(0.058)	(0.043)	(0.046)
Library availability	0.184*	0.204***	0.167***	0.113	0.142**	0.129**	0.014	0.035	0.032
	(0.095)	(0.069)	(0.063)	(0.073)	(0.056)	(0.055)	(0.085)	(0.068)	(0.068)
Nursery availability	0.018	0.147***	0.064**	0.025	0.058	0.066*	−0.005	−0.012	−0.009
	(0.051)	(0.029)	(0.028)	(0.038)	(0.037)	(0.037)	(0.038)	(0.036)	(0.036)
Constant	−0.007**	−0.004*	−0.006***	−0.008**	−0.007***	−0.008***	−0.007**	−0.005**	−0.005**
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Observations	7022	7022	7022	7022	7022	7022	7022	7022	6986
R-squared	0.090	0.079	0.089	0.090	0.083	0.083	0.089	0.088	0.088
Underidentification		0.001	0.001		0.002	0.004		0.000	0.000
Overidentification		0.472	0.225		0.480	0.428		0.291	0.372
Weak identification									
First stage F-stat.		13.93	19.27		15.59	14.6		24.63	28.37
Cragg-Donald		51.85	54.43		29.67	27.69		28.62	26.71
Kleibergen-Paap		10.437	10.975		9.736	9.121		12.285	11.307

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively. Household income is used in logarithmic form. Local financial development (FD) is measured by $fd_{it}^{(\bullet)}$. The underidentification test is an LM test based on Kleibergen and Paap (2006) rk LM statistics with the null hypothesis that the model is unidentified. The overidentification test is based on the Hansen J test with the null hypothesis being all instruments are valid. Reported numbers for underidentification and overidentification are $p-$values. For the weak identification, three alternative statistics are provided. The first one is an F statistic from the first stage regression. Staiger and Stock (1997) suggests a rule of thumb that the F statistic should be at least 10 for weak identification not to be considered a problem. The second is the Cragg–Donald F-statistics, which however requires an assumption of i.i.d. errors. The third one is a Wald F statistic based on the Kleibergen–Paap rk statistic, which is a robust counterpart of the Cragg–Donald F-statistics. The Stock-Yogo weak identification test critical values (Stock and Yogo (2005)), computed for i.i.d. errors, are the following: 5 per cent maximal IV relative bias = 21.1; 10 per cent maximal IV relative bias = 11.52; 10% maximal IV size = 50.39.

credit are poorer than those who did not. The mostly statistically insignificant estimate of the interaction between local financial development and credit demand implies that local financial development does not benefit households that apply for credit more than those that do not. This result is not unexpected given the fact that financial development and credit demand have opposite effects on household income. In fact the interaction effect is significantly negative at the sub-district level, implying that the impact of local financial development on household income is smaller for households with demand for credit than those without demand for credit.

With respect to other control variables, results confirm the significantly positive effects on household annual income of household head age and literacy. Moreover, household nucleus size positively affects household income. Households with government employee or business owner household heads have higher annual incomes than other households. Local economic development as proxied by the availability of libraries and nurseries has a positive impact on household welfare at the district and sub-district levels. The insignificance of this effect at the village levels could be explained by noting that these facilities are available in substantially smaller numbers at these administrative levels.

Model diagnostics for tests of underidentification, overidentification and weak identification are provided in the bottom rows of Table 2.5. The overidentification and underidentification tests support all the IV specifications. For the weak identification test, three alternative statistics are provided. The problem in this case is getting appropriate critical values for heteroscedastic data (Baum and Schaffer, 2012). In particular, the Stock-Yogo weak identification test critical values (Stock and Yogo, 2005) are valid only for i.i.d. errors, which is very unlikely to hold in our data as households are chosen using three stage clustering at the district, sub-district and village levels. As an alternative, one can use the Staiger and Stock (1997) rule of thumb that the F statistic from the first step regression should be at least 10 for weak identification not to be considered a problem. In both ways, the tests generally suggest the absence of a weak instrument problem. Hence, all the three tests support our main result that local financial development has a statistically significant impact on household annual income,

and this effect is not driven by reverse causality from household income to local financial development.

2.5.2 Financial development and household consumption

As an alternative measure of household welfare, we investigate the effect of local financial development on household consumption. In our data set, consumption of households consists of expenditures for food and non-food products, such as health care, education, alcoholic beverages, tobacco products and housing (Povel, 2008).

Estimation results on the determinants of household consumption are documented in Table 2.6. As in the case of household income, the impact of local financial development on household consumption is positive and statistically significant in all specifications at all administrative levels. Unlike the case of household income, credit demand has a positive and statistically significant impact on household consumption, which implies that, other things constant, households that apply for credit consume more than those who do not. Moreover, the interaction term between financial development and credit demand is positive and statistically significant in all specifications. This implies that households with demand for credit consume more in localities with a relatively more developed financial environment, perhaps reflecting the role of local financial development in consumption smoothing.

The results documented in Table 2.6 also show significant effects of other local and household characteristics on household consumption. Similar to the case of income, household head's age, literacy and being a government official and businessmen, size of agricultural production area as well as availability of libraries and nurseries in the locality have a significantly positive impact on household consumption. What is different from measuring welfare by means of annual income is that illness of the household head positively affects household consumption, but does not have significant effects on household income. This could be explained by noting that expenditures for medical treatment are considered as consumption.

Model diagnostics documented in the bottom rows of Table 2.6 show that results are supported by all underidentification, overidentification and weak identification tests.

Table 2.6: The effect of local financial development on household consumption

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.331***	0.736***	0.491***	0.248***	0.488***	0.494***	0.169**	0.273**	0.242***
	(0.083)	(0.095)	(0.062)	(0.082)	(0.103)	(0.103)	(0.070)	(0.111)	(0.084)
Credit demand	0.048***	0.049***	0.051***	0.050***	0.055***	0.054***	0.053***	0.055***	0.055***
	(0.013)	(0.009)	(0.008)	(0.013)	(0.009)	(0.009)	(0.013)	(0.008)	(0.008)
FD*Credit demand	0.165**	0.173***	0.176***	0.130*	0.175***	0.161***	0.186***	0.170***	0.164***
	(0.062)	(0.043)	(0.038)	(0.065)	(0.049)	(0.046)	(0.066)	(0.044)	(0.042)
Production area (ha)	0.008*	0.004***	0.006***	0.007*	0.003***	0.003***	0.007*	0.005***	0.006***
	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)
Male	−0.142	−0.088	−0.075	−0.170	−0.182*	−0.165*	−0.174	−0.292**	−0.303***
	(0.131)	(0.089)	(0.098)	(0.142)	(0.096)	(0.093)	(0.153)	(0.114)	(0.117)
Age	0.025***	0.011***	0.019***	0.027***	0.018***	0.018***	0.030***	0.026***	0.027***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
Disease	0.039**	0.036***	0.037***	0.037**	0.029***	0.029***	0.039**	0.022*	0.023*
	(0.017)	(0.010)	(0.009)	(0.018)	(0.010)	(0.010)	(0.018)	(0.013)	(0.013)
Literate	0.074*	0.025	0.038	0.075*	0.062**	0.062**	0.072	0.083***	0.085***
	(0.043)	(0.027)	(0.026)	(0.042)	(0.025)	(0.025)	(0.043)	(0.027)	(0.026)
Married	0.025	0.006	0.001	0.025	0.036	0.025	0.020	0.059	0.047
	(0.060)	(0.035)	(0.034)	(0.061)	(0.036)	(0.033)	(0.063)	(0.041)	(0.038)
Kinh people	−0.047	−0.053	−0.063*	−0.047	−0.023	−0.025	−0.056	−0.041	−0.031
	(0.048)	(0.036)	(0.034)	(0.052)	(0.029)	(0.029)	(0.054)	(0.039)	(0.038)
HH nucleus size	0.098***	0.102***	0.100***	0.097***	0.101***	0.101***	0.097***	0.097***	0.098***
	(0.005)	(0.004)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)
Farmer	−0.039	−0.021	−0.022	−0.036	−0.033*	−0.026	−0.038	−0.046***	−0.040***
	(0.024)	(0.017)	(0.014)	(0.025)	(0.019)	(0.017)	(0.024)	(0.014)	(0.013)
Government officials	0.034	0.056***	0.062***	0.035	0.027	0.029	0.037	0.034	0.034
and businessmen	(0.026)	(0.017)	(0.016)	(0.028)	(0.020)	(0.020)	(0.028)	(0.022)	(0.021)
Library availability	0.076***	0.108***	0.093***	0.090*	0.092**	0.087**	0.022	0.034	0.027
	(0.025)	(0.024)	(0.017)	(0.046)	(0.042)	(0.041)	(0.046)	(0.032)	(0.032)
Nursery availability	0.112***	0.156***	0.120***	0.083***	0.117***	0.119***	0.036**	0.052***	0.054***
	(0.028)	(0.023)	(0.014)	(0.020)	(0.019)	(0.019)	(0.016)	(0.011)	(0.010)
Constant	0.002	0.003*	0.002*	0.002	0.002*	0.003**	0.002	0.002**	0.002*
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	7072	7072	7072	7072	7072	7072	7072	7072	7072
R-squared	0.155	0.129	0.150	0.144	0.134	0.134	0.134	0.132	0.133
Underidentification		0.007	0.008		0.053	0.072		0.001	0.002
Overidentification		0.430	0.359		0.247	0.276		0.085	0.129
Weak identification									
First stage F-stat.		15.10	17.45		16.18	15.2		22.94	22.25
Cragg-Donald		49.21	52.13		23.45	21.9		22.33	20.85
Kleibergen-Paap		8.881	9.483		6.304	5.900		6.935	6.401

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively. Household consumption is used in logarithmic form. Local financial development (FD) is measured by $fd_{it}^{(\bullet)}$. For more details see notes to Table 2.5.

Hence, they confirm the robustness of our main result that local financial development promotes household consumption and the effect is even higher for households with demand for credit.

Table 2.7: The effect of local financial development on consumption smoothing

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	−0.317***	−0.308***	−0.335***	−0.363***	−0.100	−0.106*	−0.370***	−0.351***	−0.393***
	(0.100)	(0.077)	(0.081)	(0.098)	(0.062)	(0.063)	(0.074)	(0.085)	(0.096)
Credit demand	0.053**	0.049***	0.051***	0.054**	0.056***	0.049***	0.051*	0.065***	0.061***
	(0.024)	(0.015)	(0.015)	(0.025)	(0.013)	(0.013)	(0.025)	(0.014)	(0.013)
FD*Credit demand	0.041	0.082*	0.083*	0.039	0.046	0.024	−0.051	−0.026	−0.038
	(0.058)	(0.049)	(0.049)	(0.063)	(0.047)	(0.044)	(0.067)	(0.039)	(0.040)
Production area(ha)	0.002*	0.002***	0.002***	0.002**	0.001	0.001	0.001	0.001***	0.001***
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Male	−0.065	−0.112	−0.125	−0.053	0.007	0.011	−0.066	−0.060	−0.214**
	(0.156)	(0.103)	(0.098)	(0.160)	(0.116)	(0.115)	(0.164)	(0.122)	(0.086)
Age	0.002	−0.000	0.001	0.001	−0.006***	−0.005***	−0.001	−0.002	−0.002
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Disease	0.030**	0.030***	0.030***	0.032**	0.021**	0.026***	0.031**	0.030***	0.029***
	(0.014)	(0.007)	(0.007)	(0.014)	(0.009)	(0.009)	(0.014)	(0.010)	(0.010)
Literate	0.019	0.035	0.037	0.024	0.034	0.042*	0.025	0.025	0.042*
	(0.035)	(0.026)	(0.026)	(0.034)	(0.024)	(0.023)	(0.034)	(0.028)	(0.025)
Married	0.021	0.072***	0.072***	0.034	0.035	0.025	0.027	0.054**	0.055**
	(0.040)	(0.027)	(0.026)	(0.038)	(0.021)	(0.020)	(0.039)	(0.026)	(0.026)
Kinh people	0.071	0.036	0.036	0.060	0.055	0.053	0.068	0.034	0.035
	(0.051)	(0.034)	(0.034)	(0.050)	(0.035)	(0.035)	(0.056)	(0.033)	(0.033)
HH nucleus size	−0.003	−0.002	−0.002	−0.003	0.001	0.002	−0.003	−0.001	−0.001
	(0.005)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)
Farmer	0.025	0.003	0.004	0.022	0.014	0.024*	0.024	0.002	−0.001
	(0.024)	(0.014)	(0.014)	(0.024)	(0.016)	(0.014)	(0.023)	(0.017)	(0.016)
Government officials	−0.049	−0.055**	−0.054**	−0.049	−0.087***	−0.062***	−0.051	−0.084***	−0.082***
and businessmen	(0.035)	(0.023)	(0.023)	(0.034)	(0.026)	(0.022)	(0.035)	(0.023)	(0.025)
Library availability	−0.026	−0.010	−0.011	−0.088**	−0.050	−0.041	−0.048	−0.003	−0.012
	(0.034)	(0.016)	(0.015)	(0.040)	(0.034)	(0.033)	(0.043)	(0.036)	(0.035)
Nursery availability	−0.005	0.002	−0.006	0.007	0.025	0.018	−0.008	−0.009	−0.013
	(0.029)	(0.020)	(0.019)	(0.022)	(0.018)	(0.018)	(0.018)	(0.012)	(0.013)
Constant	−0.000	−0.001	−0.001	−0.000	0.000	0.001	−0.000	−0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Observations	12325	12325	12325	12325	12325	12325	12325	12325	12236
R-squared	0.022	0.021	0.021	0.026	0.016	0.017	0.023	0.023	0.023
Underidentification		0.012	0.014		0.184	0.222		0.018	0.044
Overidentification		0.559	0.644		0.378	0.258		0.259	0.231
Weak identification									
First stage F-stat.		50.95	64.38		49.16	50.25		37.99	44.94
Cragg-Donald		109.54	114.61		60.23	56.29		50.34	47.11
Kleibergen-Paap		6.341	7.557		12.917	12.114		9.861	8.774

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively. Local financial development (FD) is measured by $fd_{it}^{(\bullet)}$. For more details see notes to Table 2.5.

As an alternative measure of household welfare, we examine the effect of local financial development on consumption smoothing. We consider a household to have smoothened its consumption if it has not reduced consumption following a negative income shock. We construct a dummy variable which takes on a value of one if

a household says it had to reduce consumption following a negative income shock, and zero otherwise. Table 2.7 documents estimation results on the effect of local financial development and other determinants on the probability of a household cutting consumption after suffering from a negative income shock. The negative effect of local financial development on this variable implies that local financial development enables households to keep their level of consumption during periods in which household income suddenly falls. This corroborates our results in Table 2.6 that local financial development promotes household consumption for those with demand for credit.

2.5.3 Robustness checks

To check for the robustness of results documented in the previous section, we consider the availability of a bank branch at each locality as an alternative local financial development indicator (Fafchamps and Schündeln, 2013). As in the baseline estimations, we employ the heteroscedasticity-based IV estimation (Lewbel, 2012), and use time to the district center as a standard instrument for augmenting heteroscedasticity-based instruments.

Robustness check results documented in Appendix 2.7.1 are largely similar to our baseline results documented in Tables 2.5 and 2.6. In particular, except for the two IV estimations at the sub-district level, the remaining specifications show a statistically significant positive impact of local financial development on household income. At the village level, even the interaction term between bank availability and credit demand is positive, implying a stronger positive effect of bank availability on household income than the negative effect of credit demand on household income. For household consumption, however, the significant impact of local financial development is limited to all the three district level specifications and the OLS results at the sub-district level. Moreover, the interaction between bank availability and credit demand is significantly positive in sub-district level specifications only. Bank availability also reduces the probability that a household cuts consumption following a negative income shock. In general, the robustness check estimations are in line with the baseline results in showing that local financial development promotes household welfare.

2.6 Conclusions

In this paper we examined whether local financial development promotes household welfare using household-level panel data collected from three Vietnamese provinces in 2007, 2008, 2010 and 2013. Following Guiso et al. (2004), we created a local financial development indicator using regional effects from a regression of determinants of the households' access to credit. Moreover, local financial development is measured at the district, sub-district and village levels. Using the method of identification through heteroscedasticity proposed by Lewbel (2012) and the implementation procedure suggested by Baum and Schaffer (2012), we investigated the effects of local financial development on household welfare.

Our results show that district, sub-district and village-level financial development has a significantly positive impact on household annual income, consumption and consumption smoothing. Moreover, households with demand for credit benefit in terms of consumption smoothing if they live in more financially developed localities. These results are robust to measuring local financial development by means of the presence of a bank branch. Therefore, policy makers should consider enhancing access to finance at the local level as an important policy option for promoting household welfare in rural Vietnam.

To further investigate the impact of local financial development on local economic development in Vietnam, it is of immediate interest to extend this study by examining the role of financial development on firm growth in Vietnam.

2.7 Appendix for study 1

2.7.1 Appendix A1: Bank availability as a local financial development

Table A1.1: The effect of local financial development on household annual income

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.318***	0.601***	0.550***	0.114**	0.035	0.094	0.124*	0.154**	0.152**
	(0.063)	(0.070)	(0.066)	(0.054)	(0.090)	(0.085)	(0.068)	(0.062)	(0.059)
Credit demand	−0.080*	−0.102***	−0.062**	−0.060	−0.056*	−0.042	−0.057	−0.063**	−0.063***
	(0.043)	(0.033)	(0.026)	(0.042)	(0.031)	(0.029)	(0.041)	(0.028)	(0.023)
FD*Credit demand	0.002	−0.017	−0.022	0.019	0.002	−0.013	0.143	0.189**	0.159***
	(0.044)	(0.033)	(0.033)	(0.083)	(0.054)	(0.053)	(0.179)	(0.096)	(0.060)
Production area (ha)	0.008**	0.003	0.004	0.010**	0.008***	0.007**	0.011**	0.010**	0.010**
	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
Male	−0.150	−0.171	−0.134	−0.105	−0.027	0.013	−0.128	0.033	0.088
	(0.230)	(0.136)	(0.135)	(0.273)	(0.213)	(0.209)	(0.285)	(0.192)	(0.154)
Age	0.053***	0.041***	0.042***	0.069***	0.069***	0.068***	0.073***	0.072***	0.073***
	(0.009)	(0.006)	(0.006)	(0.009)	(0.006)	(0.006)	(0.009)	(0.007)	(0.006)
Disease	0.037	0.053***	0.046**	0.029	0.017	0.021	0.031	0.014	0.010
	(0.036)	(0.020)	(0.019)	(0.038)	(0.017)	(0.017)	(0.039)	(0.025)	(0.024)
Literate	0.166**	0.147***	0.171***	0.168**	0.159***	0.167***	0.179**	0.136**	0.136**
	(0.071)	(0.057)	(0.055)	(0.068)	(0.056)	(0.055)	(0.070)	(0.058)	(0.056)
Married	−0.117	−0.060	−0.095**	−0.116	−0.055	−0.079**	−0.121	−0.027	−0.030
	(0.069)	(0.045)	(0.041)	(0.071)	(0.037)	(0.034)	(0.073)	(0.051)	(0.051)
Kinh people	−0.066	−0.197**	−0.173**	0.014	0.054	0.046	0.015	−0.027	−0.017
	(0.086)	(0.077)	(0.076)	(0.087)	(0.061)	(0.060)	(0.088)	(0.067)	(0.062)
HH nucleus size	0.061***	0.058***	0.068***	0.060***	0.062***	0.063***	0.060***	0.055***	0.056***
	(0.011)	(0.010)	(0.008)	(0.011)	(0.008)	(0.008)	(0.011)	(0.006)	(0.006)
Farmer	−0.085*	−0.085***	−0.083***	−0.080*	−0.071**	−0.058**	−0.075	−0.050	−0.047
	(0.044)	(0.030)	(0.029)	(0.044)	(0.028)	(0.026)	(0.045)	(0.031)	(0.032)
Government officials	0.272***	0.249***	0.250***	0.279***	0.264***	0.282***	0.285***	0.282***	0.293***
and businessmen	(0.059)	(0.036)	(0.036)	(0.058)	(0.034)	(0.032)	(0.058)	(0.043)	(0.040)
Library availability	0.133	0.121*	0.193***	0.075	0.100*	0.094*	−0.003	−0.020	−0.029
	(0.094)	(0.072)	(0.060)	(0.076)	(0.051)	(0.050)	(0.083)	(0.056)	(0.052)
Nursery availability	0.018	0.094***	0.089***	−0.007	−0.033	−0.027	−0.032	−0.015	−0.020
	(0.041)	(0.025)	(0.024)	(0.038)	(0.025)	(0.025)	(0.038)	(0.026)	(0.026)
Constant	−0.010***	−0.011***	−0.012***	−0.007**	−0.008***	−0.010***	−0.007**	−0.006***	−0.006***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
Observations	7022	7022	7022	7022	7022	7022	7022	7022	6986
R-squared	0.104	0.087	0.092	0.084	0.082	0.083	0.082	0.081	0.081
Underidentification		0.000	0.000		0.000	0.000		0.000	0.000
Overidentification		0.457	0.282		0.905	0.786		0.487	0.565
Weak identification									
First stage F-stat.		19.73	18.45		22.51	23.49		18.63	20.4
Cragg-Donald		130.27	121.85		42.17	39.62		242.25	226.12
Kleibergen-Paap		25.049	23.470		17.313	16.224		28.444	26.532

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively. Household income is used in logarithmic form. Local financial development (FD) is measured by $bank_{it}^{(\bullet)}$. For more details see notes to Table 2.5.

Table A1.2: The effect of local financial development on household consumption

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.150***	0.253***	0.253***	0.032*	−0.022	−0.019	−0.032	−0.015	−0.028
	(0.026)	(0.023)	(0.023)	(0.016)	(0.040)	(0.037)	(0.021)	(0.028)	(0.027)
Credit demand	0.044***	0.040***	0.044***	0.051***	0.043***	0.043***	0.052***	0.055***	0.056***
	(0.013)	(0.009)	(0.008)	(0.012)	(0.008)	(0.008)	(0.012)	(0.008)	(0.008)
FD*Credit demand	0.013	0.031	0.025	0.042	0.051**	0.051**	0.001	0.011	0.003
	(0.034)	(0.019)	(0.018)	(0.038)	(0.022)	(0.022)	(0.074)	(0.048)	(0.048)
Production area (ha)	0.009*	0.011***	0.011***	0.009	0.007***	0.007***	0.009	0.005	0.006*
	(0.006)	(0.002)	(0.002)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
Male	−0.185	−0.185	−0.147	−0.176	−0.200	−0.199	−0.180	−0.245***	−0.253***
	(0.151)	(0.126)	(0.121)	(0.157)	(0.130)	(0.129)	(0.163)	(0.084)	(0.087)
Age	0.026***	0.018***	0.019***	0.032***	0.036***	0.036***	0.034***	0.037***	0.037***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)
Disease	0.044***	0.031***	0.038***	0.038**	0.038***	0.038***	0.041**	0.026	0.024
	(0.016)	(0.011)	(0.010)	(0.018)	(0.010)	(0.009)	(0.018)	(0.016)	(0.016)
Literate	0.076*	0.043	0.039	0.080*	0.045	0.044	0.079*	0.084**	0.077**
	(0.043)	(0.033)	(0.033)	(0.042)	(0.036)	(0.036)	(0.042)	(0.033)	(0.034)
Married	0.031	0.055	0.037	0.023	0.002	0.002	0.019	0.027	0.038
	(0.062)	(0.044)	(0.040)	(0.064)	(0.030)	(0.030)	(0.065)	(0.054)	(0.055)
Kinh people	−0.065	−0.072*	−0.081**	−0.058	−0.017	−0.018	−0.064	−0.071	−0.070*
	(0.058)	(0.041)	(0.040)	(0.057)	(0.041)	(0.041)	(0.055)	(0.044)	(0.042)
HH nucleus size	0.096***	0.099***	0.099***	0.097***	0.094***	0.094***	0.097***	0.097***	0.097***
	(0.005)	(0.003)	(0.003)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Farmer	−0.041*	−0.025*	−0.019	−0.041*	−0.043**	−0.043**	−0.041	−0.025	−0.027
	(0.023)	(0.014)	(0.013)	(0.024)	(0.019)	(0.018)	(0.024)	(0.018)	(0.017)
Government officials	0.034	0.028	0.031	0.035	0.037	0.037	0.038	0.038*	0.040*
and businessmen	(0.028)	(0.019)	(0.019)	(0.027)	(0.024)	(0.023)	(0.027)	(0.020)	(0.020)
Library availability	0.045*	0.027	0.042***	0.074*	0.081***	0.079***	0.018	−0.045	−0.039
	(0.027)	(0.021)	(0.016)	(0.043)	(0.020)	(0.019)	(0.045)	(0.028)	(0.027)
Nursery availability	0.099***	0.124***	0.117***	0.065***	0.043***	0.043***	0.022	0.034***	0.035***
	(0.028)	(0.017)	(0.015)	(0.019)	(0.015)	(0.015)	(0.016)	(0.009)	(0.009)
Constant	0.001	0.002	0.002*	0.002	0.001	0.001	0.002	0.003***	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	7072	7072	7072	7072	7072	7072	7072	7072	7027
R-squared	0.163	0.149	0.150	0.136	0.132	0.132	0.130	0.128	0.128
Underidentification		0.000	0.000		0.000	0.000		0.000	0.000
Overidentification		0.216	0.209		0.528	0.608		0.459	0.555
Weak identification									
First stage F-stat.		15.81	15.78		14.19	15.62		18.33	17.16
Cragg-Donald		128.42	119.91		17.39	16.49		79.26	74.06
Kleibergen-Paap		17.044	15.925		6.002	5.775		17.988	16.833

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively. Household consumption is used in logarithmic form. Local financial development (FD) is measured by $bank_{it}^{(\bullet)}$. For more details see notes to Table 2.5.

2.7.2 Appendix A2: Panel based estimates of regional effects as a local financial development indicator

In the main text of the paper, we employed a local financial development indicator fd_{it} generated from regional effects in the regression of a households' probability of being credit rationed. Given the panel nature of our data, we allowed local financial development to vary over time by using year-specific regressions for the model of

Table A1.3: The effect of local financial development on consumption smoothing

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	−0.127***	−0.124***	−0.126***	−0.044*	−0.166***	−0.154***	−0.102	−0.192***	−0.209***
	(0.028)	(0.027)	(0.027)	(0.022)	(0.059)	(0.058)	(0.063)	(0.040)	(0.035)
Credit demand	0.055**	0.052***	0.054***	0.048**	0.058***	0.053***	0.044*	0.056***	0.049***
	(0.023)	(0.014)	(0.014)	(0.023)	(0.013)	(0.012)	(0.022)	(0.016)	(0.016)
FD*Credit demand	0.023	0.021	0.023	0.034	−0.012	0.009	0.049	0.021	−0.000
	(0.032)	(0.024)	(0.024)	(0.036)	(0.025)	(0.018)	(0.106)	(0.069)	(0.062)
Production area(ha)	0.001	0.002***	0.002***	−0.001	−0.001	−0.002	−0.002	−0.002	−0.002
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.004)	(0.002)	(0.002)
Male	−0.051	−0.021	−0.036	−0.052	−0.107	−0.041	−0.037	−0.107	−0.086
	(0.154)	(0.099)	(0.096)	(0.167)	(0.142)	(0.135)	(0.160)	(0.119)	(0.097)
Age	−0.000	−0.002	−0.001	−0.006**	−0.003	−0.003	−0.008***	−0.009***	−0.009***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.002)	(0.001)	(0.001)
Disease	0.025*	0.035***	0.034***	0.028*	0.021**	0.016*	0.028*	0.026**	0.022**
	(0.015)	(0.011)	(0.011)	(0.015)	(0.010)	(0.010)	(0.015)	(0.012)	(0.011)
Literate	0.019	0.018	0.020	0.016	0.053*	0.057**	0.011	0.033	0.020
	(0.034)	(0.022)	(0.022)	(0.035)	(0.028)	(0.028)	(0.035)	(0.023)	(0.023)
Married	0.013	0.017	0.013	0.036	0.074***	0.064**	0.032	0.034	0.015
	(0.042)	(0.029)	(0.028)	(0.040)	(0.028)	(0.026)	(0.043)	(0.026)	(0.023)
Kinh people	0.091	0.052	0.057	0.074	0.010	0.019	0.088	0.069**	0.073**
	(0.060)	(0.037)	(0.036)	(0.057)	(0.026)	(0.025)	(0.064)	(0.031)	(0.030)
HH nucleus size	−0.001	0.000	0.001	−0.002	0.003	0.004	−0.002	0.001	0.002
	(0.005)	(0.004)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)
Farmer	0.027	0.032*	0.031*	0.027	0.011	0.010	0.028	0.016	0.014
	(0.023)	(0.018)	(0.018)	(0.023)	(0.010)	(0.010)	(0.023)	(0.013)	(0.014)
Government officials	−0.048	−0.043**	−0.044**	−0.055	−0.084***	−0.064***	−0.056	−0.088***	−0.088***
and businessmen	(0.035)	(0.021)	(0.021)	(0.035)	(0.021)	(0.016)	(0.037)	(0.024)	(0.025)
Library availability	0.007	0.017	0.025	−0.066	−0.039	−0.053*	−0.034	−0.013	−0.001
	(0.043)	(0.027)	(0.023)	(0.043)	(0.033)	(0.031)	(0.053)	(0.034)	(0.033)
Nursery availability	0.018	0.015	0.012	0.035*	0.004	0.004	0.011	0.016	0.019
	(0.025)	(0.018)	(0.017)	(0.017)	(0.021)	(0.020)	(0.016)	(0.013)	(0.013)
Constant	−0.000	0.000	0.000	−0.000	−0.000	0.000	0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	12325	12325	12325	12325	12325	12325	12325	12325	12236
R-squared	0.023	0.022	0.022	0.011	−0.003	−0.000	0.009	0.007	0.006
Underidentification		0.000	0.000		0.013	0.017		0.000	0.001
Overidentification		0.280	0.325		0.546	0.566		0.236	0.214
Weak identification									
First stage F-stat.		36.45	35.82		2.67	2.72		29.9	28
Cragg-Donald		170.65	161.28		11.58	11.09		64.54	60.38
Kleibergen-Paap		26.396	25.919		2.118	1.993		12.743	10.922

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1 per cent, 5 per cent and 10 per cent is indicated by ***, **, and *, respectively. Local financial development (FD) is measured by $bank_{it}^{(\bullet)}$. For more details see notes to Table 2.5.

determinants of credit rationing in Table 3. The resulting local financial development indicator $fd2_{it}^{(\bullet)}$ is used to obtain results reported in Tables 5, 6 and 7 in the main body of the paper.

In this supplement, we do a robustness check by alternatively performing a pooled regression of Table 3 including year dummies, and construct the local financial development indicator as a function of local and year dummies. Namely, we estimate

the following linear pooled OLS model

$$CR_{hit} = \boldsymbol{w}'_{hit}\boldsymbol{\alpha}_t + V_i\beta_i + Year_t\mu_t + \nu_{hit}, \tag{2.5}$$

where $Year_t$ is a year dummy and the remaining variables are as defined in (2.1).

Results documented in Table A2.1 are qualitatively similar to year-specific results documented in Table 3. In particular, while credit rationing CR_{hit} is positively affected by a bad credit history and illness of the household head, it is negatively affected by household annual income. Unlike results in Table 3, however, household nucleus size is not statistically significant in the pooled estimation results reported in Table A2.1. Moreover, year dummies have negative signs whose magnitudes increase from year to year. This indicates that financial development was generally growing over time in the three Vietnamese provinces in the period 2007-2013.

Based on pooled regression estimates of locality and year dummies in (2.5), we construct the alternative time-varying local financial development indicator as

$$fd2_{it}^{(\bullet)} = \left(1 - \frac{\hat{\beta}_i + \hat{\mu}_t}{\hat{\beta}_{max} + \hat{\mu}_{max}}\right). \tag{2.6}$$

where $\hat{\beta}_{max}$ is the maximum of $\hat{\boldsymbol{\beta}} = (\hat{\beta}_1, ..., \hat{\beta}_{N^{(\bullet)}})$ and $\hat{\mu}_{max}$ is the maximum of $\hat{\boldsymbol{\mu}} = (\hat{\mu}_1, ..., \hat{\mu}_T)$, with $i = 1, ..., N^{(\bullet)}$ and $t = 1, ..., T$.

In (2.6), a higher $fd2_{it}^{(\bullet)}$ indicates a more financially developed locality i in year t. The locality index could refer to a village v, a sub-district s or a district d, i.e $\bullet \in \{v, s, d\}$. Table A2.2 documents the summary statistics of the local financial development indicator $fd2_{it}^{(\bullet)}$. The indicator $fd2_{it}^{(\bullet)}$ has a strong, positive correlation with our main indicator $fd_{it}^{(\bullet)}$ and the other alternative $bank_{it}^{(\bullet)}$.

Results on the impact on household income, annual consumption and consumption smoothing of local financial development as measured by $fd2_{it}^{(\bullet)}$ are documented in Tables A2.3, A2.4 and A2.5 and are largely similar to those of using $fd_{it}^{(\bullet)}$ and $bank_{it}^{(s)}$ as financial development indicators documented in the paper. Specifically, local financial development as measured by $fd2_{it}^{(\bullet)}$ positively impacts on household annual income and

consumption. Moreover, local financial development increases household consumption for households with demand for credit more than it increases the consumption of households with no demand for credit. With regard to specification tests, all IV results are supported by the underidentification, overidentification and weak identification tests.

Table A2.1: Determinants of credit rationing (Pooled OLS)

	District	Sub-district	Village
Late repayment and default	0.050***	0.047***	0.047***
	(0.006)	(0.006)	(0.006)
HH income	−0.015***	−0.016***	−0.015***
	(0.004)	(0.004)	(0.004)
Production area (ha)	−0.004	−0.002	−0.002
	(0.003)	(0.003)	(0.003)
Male	−0.007	−0.008	−0.006
	(0.018)	(0.019)	(0.019)
Age	−0.000	−0.000	−0.000
	(0.000)	(0.000)	(0.000)
Disease	0.017*	0.017*	0.017*
	(0.009)	(0.009)	(0.009)
Literate	0.002	−0.001	−0.005
	(0.015)	(0.015)	(0.016)
Married	−0.009	−0.005	−0.002
	(0.020)	(0.020)	(0.021)
Kinh people	0.013	0.024	0.024
	(0.015)	(0.019)	(0.030)
HH nucleus size	−0.001	−0.001	−0.002
	(0.003)	(0.003)	(0.003)
Farmer	0.017	0.015	0.015
	(0.012)	(0.012)	(0.012)
Government officials and businessmen	0.011	0.007	−0.004
	(0.018)	(0.018)	(0.018)
2007	0.318***	0.299***	0.263**
	(0.065)	(0.078)	(0.125)
2008	0.175***	0.154**	0.117
	(0.065)	(0.078)	(0.125)
2010	0.175***	0.154*	0.118
	(0.066)	(0.079)	(0.126)
2013	0.180***	0.159**	0.122
	(0.067)	(0.080)	(0.126)
Local dummies	Yes	Yes	Yes
Observations	5357	5357	5357
Adjusted R-squared	0.174	0.175	0.177

Notes: the values provided in parentheses are estimated robust standard errors. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively.

Table A2.2: Local financial development indicators

Panel A: Summary Statistics

Variable	Level	Obs.	Mean	Std.Dev.	Min	Max
$fd2_{it}^{(d)}$	district	8788	0.490	0.170	0	0.824
$fd2_{it}^{(s)}$	sub-district	8788	0.516	0.178	0	0.831
$fd2_{it}^{(v)}$	village	8788	0.566	0.192	0	0.921

Panel B: Correlation between LFD

	$fd2_{it}^{(d)}$	$fd2_{it}^{(s)}$	$fd2_{it}^{(v)}$	$fd_{it}^{(d)}$	$fd_{it}^{(s)}$	$fd_{it}^{(v)}$
$fd2_{it}^{(d)}$	1					
$fd2_{it}^{(s)}$	0.895*	1				
$fd2_{it}^{(v)}$	0.775*	0.871*	1			
$fd_{it}^{(d)}$	0.728*	0.650*	0.562*	1		
$fd_{it}^{(s)}$	0.668*	0.702*	0.611*	0.867*	1	
$fd_{it}^{(v)}$	0.590*	0.618*	0.657*	0.748*	0.862*	1

Panel C: Correlation between LFD and Bank

	$fd2_{it}^{(d)}$	$fd2_{it}^{(s)}$	$fd2_{it}^{(v)}$	$bank_{it}^{(d)}$	$bank_{it}^{(s)}$	$bank_{it}^{(v)}$
$bank_{it}^{(d)}$	0.498*	0.443*	0.384*	1		
$bank_{it}^{(s)}$	0.264*	0.228*	0.191*	0.417*	1	
$bank_{it}^{(v)}$	0.089*	0.058*	0.043*	0.153*	0.367*	1

Notes: significance at the 1% is indicated by *.

Table A2.3: The effect of local financial development on household annual income

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	1.397***	1.687***	1.579***	1.427***	1.651***	1.581***	1.490***	1.770***	1.560***
	(0.209)	(0.134)	(0.128)	(0.231)	(0.225)	(0.221)	(0.244)	(0.304)	(0.284)
Credit demand	−0.061	−0.083***	−0.068**	−0.060	−0.039	−0.039	−0.059	−0.052*	−0.053*
	(0.041)	(0.029)	(0.028)	(0.040)	(0.026)	(0.026)	(0.040)	(0.027)	(0.027)
FD*Credit demand	0.155	0.066	0.163*	0.177	0.099	0.177	0.190	0.107	0.214
	(0.151)	(0.101)	(0.094)	(0.167)	(0.129)	(0.122)	(0.178)	(0.135)	(0.135)
Production area (ha)	0.008**	0.004	0.005**	0.006	0.005**	0.005**	0.006	0.005*	0.006**
	(0.004)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.004)	(0.003)	(0.003)
Male	0.025	0.073	0.146	−0.001	−0.025	0.038	−0.004	−0.013	0.093
	(0.210)	(0.142)	(0.139)	(0.209)	(0.134)	(0.129)	(0.213)	(0.138)	(0.130)
Age	0.039***	0.030***	0.035***	0.041***	0.037***	0.039***	0.042***	0.036***	0.040***
	(0.008)	(0.005)	(0.005)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Disease	0.048	0.070***	0.060***	0.049	0.068***	0.058**	0.051	0.063**	0.051**
	(0.037)	(0.023)	(0.023)	(0.038)	(0.024)	(0.024)	(0.038)	(0.025)	(0.024)
Literate	0.149*	0.151***	0.164***	0.151**	0.151***	0.162***	0.148**	0.136**	0.155***
	(0.073)	(0.051)	(0.051)	(0.072)	(0.054)	(0.054)	(0.072)	(0.053)	(0.051)
Married	−0.051	0.022	−0.021	−0.044	0.019	−0.018	−0.045	0.026	−0.016
	(0.071)	(0.041)	(0.038)	(0.070)	(0.044)	(0.039)	(0.070)	(0.048)	(0.042)
Kinh people	0.145	0.115	0.136*	0.134	0.086	0.106	0.134	0.132	0.180**
	(0.097)	(0.079)	(0.079)	(0.097)	(0.079)	(0.079)	(0.098)	(0.082)	(0.079)
HH nucleus size	0.063***	0.062***	0.065***	0.060***	0.058***	0.060***	0.060***	0.052***	0.056***
	(0.011)	(0.008)	(0.008)	(0.011)	(0.008)	(0.007)	(0.011)	(0.007)	(0.007)
Farmer	−0.051	−0.034	−0.022	−0.049	−0.057	−0.039	−0.049	−0.051	−0.050
	(0.046)	(0.028)	(0.028)	(0.048)	(0.037)	(0.037)	(0.047)	(0.037)	(0.037)
Government officials	0.295***	0.265***	0.265***	0.297***	0.242***	0.265***	0.298***	0.271***	0.277***
and businessmen	(0.063)	(0.038)	(0.038)	(0.061)	(0.035)	(0.034)	(0.062)	(0.038)	(0.038)
Library availability	0.192**	0.197***	0.214***	0.120*	0.165***	0.160***	0.021	0.018	0.076
	(0.085)	(0.045)	(0.044)	(0.067)	(0.041)	(0.040)	(0.086)	(0.062)	(0.056)
Nursery availability	0.057	0.078***	0.081***	0.058	0.071**	0.079***	0.027	0.031	0.014
	(0.039)	(0.028)	(0.028)	(0.038)	(0.029)	(0.029)	(0.039)	(0.029)	(0.029)
Constant	−0.012***	−0.010***	−0.012***	−0.012***	−0.012***	−0.013***	−0.012***	−0.012***	−0.012***
	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Observations	7022	7022	7022	7022	7022	7022	7022	7022	6986
R-squared	0.127	0.125	0.126	0.123	0.121	0.122	0.122	0.120	0.123
Underidentification		0.000	0.000		0.000	0.000		0.000	0.000
Overidentification		0.730	0.270		0.526	0.295		0.787	0.499
Weak identification									
First stage F-stat.		47.5	59.96		54.85	51.83		22.65	21.28
Cragg-Donald		871.58	813.38		135.9	128.06		97.26	91.46
Kleibergen-Paap		63.737	65.432		45.656	42.695		27.415	25.683

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively. Household income is used in logarithmic form. Local financial development (FD) is measured by $fd2_{it}^{(\bullet)}$. The Stock-Yogo weak identification test critical values (Stock and Yogo (2005)), computed for i.i.d. errors, are the following: 5% maximal IV relative bias = 21; 10% maximal IV relative bias = 11.52; 10% maximal IV size = 43.27 for hetero IV results and 45.64 for all IV results.

Table A2.4: The effect of local financial development on household annual consumption

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.656***	0.595***	0.590***	0.624***	0.807***	0.833***	0.616***	0.892***	0.890***
	(0.072)	(0.060)	(0.060)	(0.076)	(0.091)	(0.088)	(0.081)	(0.100)	(0.100)
Credit demand	0.049***	0.052***	0.053***	0.049***	0.049***	0.046***	0.050***	0.052***	0.053***
	(0.012)	(0.008)	(0.008)	(0.012)	(0.009)	(0.008)	(0.012)	(0.009)	(0.008)
FD*Credit demand	0.158	0.213***	0.207***	0.179	0.251***	0.236***	0.182	0.236***	0.231***
	(0.123)	(0.067)	(0.067)	(0.135)	(0.082)	(0.081)	(0.143)	(0.087)	(0.084)
Production area (ha)	0.009*	0.009***	0.008***	0.007	0.004***	0.004***	0.006*	0.004***	0.004***
	(0.005)	(0.002)	(0.002)	(0.004)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)
Male	−0.099	0.019	0.033	−0.121	−0.070	−0.040	−0.130	−0.008	0.013
	(0.131)	(0.083)	(0.082)	(0.129)	(0.086)	(0.080)	(0.129)	(0.091)	(0.082)
Age	0.019***	0.020***	0.021***	0.019***	0.016***	0.015***	0.020***	0.014***	0.015***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Disease	0.049***	0.050***	0.051***	0.046***	0.046***	0.046***	0.047***	0.060***	0.058***
	(0.015)	(0.011)	(0.011)	(0.016)	(0.010)	(0.010)	(0.016)	(0.009)	(0.009)
Literate	0.069	0.046*	0.046*	0.070	0.048**	0.051**	0.067	0.056**	0.057**
	(0.044)	(0.024)	(0.024)	(0.042)	(0.023)	(0.023)	(0.042)	(0.026)	(0.025)
Married	0.034	−0.006	−0.025	0.039	0.029	0.020	0.034	−0.013	−0.018
	(0.058)	(0.037)	(0.031)	(0.058)	(0.027)	(0.026)	(0.060)	(0.037)	(0.032)
Kinh people	−0.030	−0.037	−0.028	−0.034	−0.054	−0.037	−0.038	−0.044	−0.028
	(0.053)	(0.038)	(0.037)	(0.054)	(0.039)	(0.036)	(0.054)	(0.043)	(0.039)
HH nucleus size	0.098***	0.097***	0.097***	0.097***	0.096***	0.097***	0.097***	0.097***	0.098***
	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Farmer	−0.032	−0.013	−0.011	−0.030	−0.007	−0.004	−0.032	−0.007	−0.006
	(0.023)	(0.013)	(0.013)	(0.024)	(0.015)	(0.014)	(0.024)	(0.015)	(0.014)
Government officials	0.039	0.062***	0.058***	0.037	0.056***	0.051***	0.039	0.060***	0.055***
and businessmen	(0.027)	(0.018)	(0.017)	(0.029)	(0.019)	(0.019)	(0.028)	(0.018)	(0.017)
Library availability	0.073***	0.059***	0.061***	0.096**	0.041	0.043	0.030	−0.038	−0.043
	(0.022)	(0.011)	(0.011)	(0.046)	(0.034)	(0.034)	(0.049)	(0.037)	(0.037)
Nursery availability	0.117***	0.111***	0.107***	0.098***	0.104***	0.103***	0.053***	0.059***	0.060***
	(0.026)	(0.013)	(0.012)	(0.018)	(0.011)	(0.011)	(0.016)	(0.012)	(0.012)
Constant	0.000	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	7072	7072	7072	7072	7072	7072	7072	7072	7027
R-squared	0.189	0.188	0.187	0.177	0.172	0.171	0.167	0.158	0.159
Underidentification		0.000	0.000		0.000	0.000		0.000	0.000
Overidentification		0.483	0.493		0.341	0.341		0.657	0.723
Weak identification									
First stage F-stat.		38.54	52.73		48.79	47.45		16.97	16.63
Cragg-Donald		854.65	797.62		145.99	137.85		100.07	94.18
Kleibergen-Paap		57.268	61.786		32.196	30.480		16.909	15.831

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively. Household consumption is used in logarithmic form. Local financial development (FD) is measured by $fd2_{it}^{(\bullet)}$.

Table A2.5: The effect of local financial development on consumption smoothing

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	−0.506***	−0.347***	−0.336***	−0.544***	−0.294***	−0.207***	−0.586***	−0.316***	−0.271***
	(0.101)	(0.068)	(0.066)	(0.096)	(0.069)	(0.062)	(0.102)	(0.071)	(0.067)
Credit demand	0.055**	0.055***	0.061***	0.056**	0.071***	0.064***	0.055**	0.069***	0.062***
	(0.022)	(0.015)	(0.013)	(0.022)	(0.014)	(0.014)	(0.022)	(0.016)	(0.015)
FD*Credit demand	0.084	0.153***	0.162***	0.097	0.133**	0.134**	0.102	0.161**	0.171**
	(0.089)	(0.057)	(0.057)	(0.094)	(0.064)	(0.065)	(0.100)	(0.069)	(0.070)
Production area(ha)	0.001	0.001	0.001	0.001	0.001	−0.001	0.001	0.001	0.001
	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)
Male	−0.089	0.015	0.010	−0.086	0.003	0.046	−0.086	−0.051	−0.184**
	(0.165)	(0.110)	(0.109)	(0.167)	(0.103)	(0.102)	(0.165)	(0.107)	(0.078)
Age	0.004	−0.001	−0.001	0.004	−0.004**	−0.005***	0.004	−0.004***	−0.005***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)	(0.001)
Disease	0.023	0.016*	0.018**	0.024	0.018*	0.022**	0.023	0.024***	0.025***
	(0.016)	(0.008)	(0.008)	(0.016)	(0.009)	(0.009)	(0.016)	(0.009)	(0.009)
Literate	0.031	0.048	0.055*	0.031	0.040	0.045	0.030	0.034	0.042
	(0.038)	(0.032)	(0.031)	(0.038)	(0.033)	(0.033)	(0.039)	(0.032)	(0.031)
Married	0.013	0.067**	0.059**	0.018	0.041*	0.052**	0.014	0.031	0.029
	(0.040)	(0.028)	(0.026)	(0.037)	(0.023)	(0.022)	(0.039)	(0.024)	(0.022)
Kinh people	0.063	0.009	0.021	0.061	0.031	0.014	0.062	0.008	0.001
	(0.058)	(0.044)	(0.041)	(0.054)	(0.042)	(0.041)	(0.057)	(0.038)	(0.038)
HH nucleus size	−0.004	−0.001	−0.001	−0.003	−0.001	0.000	−0.003	−0.001	0.000
	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)
Farmer	0.021	−0.000	0.004	0.020	0.011	0.012	0.021	0.015	0.013
	(0.023)	(0.017)	(0.017)	(0.023)	(0.017)	(0.017)	(0.023)	(0.017)	(0.017)
Government officials	−0.047	−0.076***	−0.074***	−0.048	−0.106***	−0.083***	−0.048	−0.102***	−0.100***
and businessmen	(0.033)	(0.022)	(0.022)	(0.033)	(0.022)	(0.020)	(0.034)	(0.025)	(0.023)
Library availability	−0.016	−0.018	−0.012	−0.084**	−0.069**	−0.044	−0.057	−0.050*	−0.052*
	(0.037)	(0.019)	(0.018)	(0.040)	(0.029)	(0.028)	(0.043)	(0.029)	(0.030)
Nursery availability	0.006	0.030	0.024	0.010	0.026*	0.020	−0.006	0.006	0.005
	(0.024)	(0.019)	(0.017)	(0.018)	(0.016)	(0.015)	(0.016)	(0.012)	(0.012)
Constant	−0.000	−0.000	0.000	−0.000	0.000	0.000	−0.000	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)
Observations	12326	12326	12326	12326	12326	12326	12326	12326	12236
R-squared	0.031	0.028	0.028	0.032	0.027	0.023	0.032	0.026	0.024
Underidentification		0.000	0.000		0.000	0.000		0.000	0.000
Overidentification		0.553	0.565		0.644	0.220		0.511	0.443
Weak identification									
First stage F-stat.		59.61	56.92		247.78	235.21		70.24	65.57
Cragg-Donald		459.26	431.63		167.08	156.09		128.2	119.64
Kleibergen-Paap		76.783	71.278		31.458	29.497		22.883	21.692

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively. Local financial development (FD) is measured by $fd2_{it}^{(\bullet)}$.

2.7.3 Appendix A3: Local financial development indicators based on households' credit-rationed by formal credit suppliers only

In this section, we provide results obtained by using new local financial development indicators, which are created from regional effects based on HHs credit-rationed by formal credit suppliers, such as government banks, commercial banks, but excluding informal credit suppliers such as money lenders, families and friends.

Table A3.1: Determinants of credit rationing

	District				Village			
	2007	2008	2010	2013	2007	2008	2010	2013
Late repayment and default	0.090***	0.028***	0.001	0.021*	0.090***	0.028**	−0.000	0.028**
	(0.015)	(0.010)	(0.009)	(0.012)	(0.017)	(0.011)	(0.010)	(0.014)
HH income	−0.005	−0.007	−0.009	−0.008	−0.006	−0.010	−0.005	−0.005
	(0.010)	(0.006)	(0.008)	(0.009)	(0.012)	(0.007)	(0.008)	(0.011)
Production area(ha)	0.188*	−0.001	−0.001	0.003	0.246*	0.001	−0.001	0.005
	(0.108)	(0.006)	(0.003)	(0.004)	(0.127)	(0.007)	(0.004)	(0.005)
Male	0.013	−0.020	0.030	−0.047	−0.004	−0.044	0.028	−0.038
	(0.048)	(0.024)	(0.030)	(0.038)	(0.056)	(0.027)	(0.032)	(0.046)
Age	−0.000	−0.001	0.000	−0.000	−0.000	−0.001	0.000	−0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Disease	0.034	0.003	0.002	0.005	0.048	−0.007	−0.009	−0.003
	(0.025)	(0.014)	(0.015)	(0.018)	(0.030)	(0.015)	(0.016)	(0.021)
Literate	0.004	0.023	0.037	−0.004	0.004	0.038	0.052*	−0.008
	(0.042)	(0.022)	(0.025)	(0.033)	(0.049)	(0.026)	(0.028)	(0.040)
Married	−0.073	0.000	−0.004	0.020	−0.042	0.029	−0.011	−0.004
	(0.052)	(0.026)	(0.034)	(0.043)	(0.061)	(0.030)	(0.037)	(0.051)
Kinh people	0.016	−0.013	−0.029	−0.032	0.007	0.029	−0.059	−0.017
	(0.044)	(0.022)	(0.025)	(0.038)	(0.128)	(0.052)	(0.050)	(0.093)
HH nucleus size	−0.002	0.001	0.001	0.010*	−0.003	0.002	−0.002	0.010
	(0.007)	(0.004)	(0.004)	(0.005)	(0.008)	(0.004)	(0.005)	(0.006)
Farmer	0.034	0.022	−0.008	0.017	−0.011	0.027	−0.023	0.006
	(0.034)	(0.016)	(0.019)	(0.023)	(0.040)	(0.018)	(0.020)	(0.026)
Government officials	−0.001	0.011	−0.021	−0.008	−0.017	0.019	−0.054*	−0.009
and businessmen	(0.047)	(0.023)	(0.028)	(0.034)	(0.056)	(0.026)	(0.030)	(0.039)
Local dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	885	1115	1047	695	885	1115	1047	695
Adjusted R-squared	0.173	0.047	0.047	0.048	0.137	0.020	0.123	0.042

Notes: the values provided in parentheses are estimated robust standard errors. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively.

Table A3.2: Local financial development indicators

Panel A: Summary Statistics

Variable	Obs.	Mean	Std.Dev.	Min	Max
$fd_{it}^{(d)}$	8788	0.589	0.219	0	1.003
$fd_{it}^{(s)}$	8788	0.911	0.111	0	1.111
$fd_{it}^{(v)}$	8788	0.900	0.139	0	1.353
$bank_{it}^{(d)}$	8788	0.685	0.465	0	1
$bank_{it}^{(s)}$	8788	0.274	0.446	0	1
$bank_{it}^{(v)}$	8788	0.048	0.215	0	1

Panel B: Correlation between local financial development indicators and bank availability

	$fd_{it}^{(d)}$	$fd_{it}^{(s)}$	$fd_{it}^{(v)}$	$bank_{it}^{(d)}$	$bank_{it}^{(s)}$	$bank_{it}^{(v)}$
$fd_{it}^{(d)}$	1					
$fd_{it}^{(s)}$	0.5482*	1				
$fd_{it}^{(v)}$	0.4777*	0.6651*	1			
$bank_{it}^{(d)}$	0.3035*	0.1179*	0.2075*	1		
$bank_{it}^{(s)}$	0.1402*	0.0332*	0.0691*	0.4169*	1	
$bank_{it}^{(v)}$	0.0365*	-0.0004	-0.0012	0.1530*	0.3669*	1

Notes: significance at the 1% is indicated by *.

Table A3.3: The effect of local financial development on household income

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.314**	0.669***	0.577***	0.187	0.683***	0.338**	0.575***	0.657***	0.641***
	(0.148)	(0.124)	(0.114)	(0.185)	(0.140)	(0.140)	(0.145)	(0.123)	(0.120)
Credit demand	−0.060	−0.050*	−0.051*	−0.059	−0.095***	−0.083***	−0.060	−0.042**	−0.047**
	(0.042)	(0.026)	(0.026)	(0.043)	(0.023)	(0.021)	(0.045)	(0.021)	(0.020)
FD*Credit demand	−0.037	−0.279***	−0.251***	−0.493**	−0.321**	−0.415***	−0.115	−0.173	−0.195
	(0.125)	(0.087)	(0.087)	(0.202)	(0.140)	(0.114)	(0.204)	(0.133)	(0.134)
Production area (ha)	0.009*	0.005*	0.006**	0.011**	0.014***	0.012***	0.010**	0.013***	0.011***
	(0.005)	(0.003)	(0.003)	(0.005)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Male	−0.101	−0.165	−0.158	−0.125	−0.339	−0.119	−0.120	−0.137	0.008
	(0.264)	(0.195)	(0.197)	(0.285)	(0.241)	(0.226)	(0.278)	(0.219)	(0.202)
Age	0.066***	0.070***	0.072***	0.073***	0.077***	0.078***	0.071***	0.077***	0.077***
	(0.009)	(0.005)	(0.005)	(0.009)	(0.008)	(0.007)	(0.009)	(0.006)	(0.006)
Disease	0.028	0.005	0.003	0.030	0.025	0.007	0.035	0.051*	0.035
	(0.037)	(0.025)	(0.024)	(0.038)	(0.020)	(0.019)	(0.039)	(0.030)	(0.025)
Literate	0.177**	0.264***	0.256***	0.179**	0.217***	0.207***	0.172**	0.185***	0.197***
	(0.072)	(0.049)	(0.048)	(0.070)	(0.051)	(0.050)	(0.069)	(0.044)	(0.042)
Married	−0.115	−0.047	−0.059	−0.123*	−0.080	−0.089*	−0.114	−0.053	−0.061
	(0.071)	(0.056)	(0.054)	(0.072)	(0.051)	(0.051)	(0.072)	(0.047)	(0.047)
Kinh people	0.035	−0.083	−0.064	0.020	−0.015	0.023	0.028	−0.013	−0.007
	(0.089)	(0.070)	(0.066)	(0.088)	(0.068)	(0.066)	(0.093)	(0.061)	(0.060)
HH nucleus size	0.062***	0.068***	0.069***	0.060***	0.059***	0.066***	0.059***	0.064***	0.066***
	(0.012)	(0.010)	(0.009)	(0.011)	(0.008)	(0.007)	(0.011)	(0.008)	(0.008)
Farmer	−0.076	−0.081***	−0.076***	−0.079*	−0.072***	−0.066**	−0.071	−0.072***	−0.071***
	(0.045)	(0.023)	(0.023)	(0.045)	(0.028)	(0.028)	(0.046)	(0.026)	(0.027)
Government officials	0.282***	0.213***	0.207***	0.282***	0.220***	0.235***	0.282***	0.227***	0.236***
and businessman	(0.059)	(0.047)	(0.046)	(0.058)	(0.040)	(0.040)	(0.057)	(0.035)	(0.035)
Library availability	0.167*	0.138**	0.155***	0.078	0.050	0.032	−0.014	−0.039	−0.045
	(0.091)	(0.063)	(0.058)	(0.076)	(0.048)	(0.045)	(0.084)	(0.051)	(0.050)
Nursery availability	−0.028	0.050	0.035	−0.027	−0.004	−0.013	−0.044	−0.064**	−0.065**
	(0.048)	(0.038)	(0.036)	(0.035)	(0.030)	(0.029)	(0.038)	(0.032)	(0.031)
Constant	−0.008**	−0.006**	−0.007***	−0.007**	−0.007***	−0.008***	−0.008**	−0.008***	−0.008***
	(0.003)	(0.003)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Observations	7022	7022	7022	7022	7022	7022	7022	7022	6986
R-squared	0.088	0.080	0.083	0.082	0.078	0.081	0.089	0.087	0.088
Underidentification		0.000	0.000		0.000	0.000		0.001	0.001
Overidentification		0.203	0.227		0.173	0.108		0.227	0.226
Weak identification		17.141	16.490		5.137	5.393		9.066	8.665

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively. Household consumption is used in logarithmic form. Local financial development (FD) is measured by $fd_{it}^{(\bullet)}$.

Table A3.4: The effect of local financial development on household consumption

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	0.141**	0.832***	0.810***	0.127	0.213**	0.145	0.254***	0.705***	0.691***
	(0.067)	(0.165)	(0.141)	(0.085)	(0.089)	(0.089)	(0.069)	(0.148)	(0.136)
Credit demand	0.051***	0.044***	0.046***	0.051***	0.060***	0.061***	0.051***	0.062***	0.061***
	(0.013)	(0.010)	(0.010)	(0.012)	(0.008)	(0.008)	(0.013)	(0.009)	(0.007)
FD*Credit demand	0.088	0.015	0.006	0.084	0.141*	0.147**	0.099	0.085*	0.099**
	(0.084)	(0.061)	(0.056)	(0.126)	(0.072)	(0.073)	(0.084)	(0.051)	(0.045)
Production area (ha)	0.010*	0.005***	0.006***	0.009	0.008***	0.009***	0.008	0.009***	0.008***
	(0.006)	(0.002)	(0.002)	(0.006)	(0.001)	(0.001)	(0.005)	(0.002)	(0.002)
Male	−0.163	−0.136**	−0.160***	−0.182	−0.270***	−0.261***	−0.181	−0.284**	−0.302**
	(0.149)	(0.060)	(0.055)	(0.159)	(0.092)	(0.091)	(0.154)	(0.124)	(0.125)
Age	0.032***	0.019***	0.019***	0.033***	0.031***	0.031***	0.032***	0.028***	0.029***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
Disease	0.040**	0.028**	0.029**	0.039**	0.033**	0.030**	0.042**	0.043***	0.042***
	(0.017)	(0.013)	(0.012)	(0.018)	(0.014)	(0.013)	(0.018)	(0.012)	(0.012)
Literate	0.078*	0.038	0.046	0.080*	0.102***	0.100***	0.074*	0.075***	0.075***
	(0.043)	(0.035)	(0.033)	(0.042)	(0.029)	(0.029)	(0.042)	(0.028)	(0.024)
Married	0.017	0.018	0.017	0.021	0.017	0.022	0.020	0.025	0.023
	(0.063)	(0.040)	(0.040)	(0.064)	(0.040)	(0.040)	(0.065)	(0.049)	(0.047)
Kinh people	−0.061	−0.088***	−0.099***	−0.063	−0.097***	−0.097***	−0.062	−0.101***	−0.088***
	(0.051)	(0.027)	(0.024)	(0.055)	(0.026)	(0.026)	(0.054)	(0.032)	(0.030)
HH nucleus size	0.097***	0.096***	0.097***	0.097***	0.096***	0.098***	0.096***	0.098***	0.097***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
Farmer	−0.040*	−0.013	−0.012	−0.040	−0.038**	−0.040**	−0.037	−0.042***	−0.039***
	(0.023)	(0.016)	(0.016)	(0.024)	(0.016)	(0.016)	(0.024)	(0.014)	(0.013)
Government officials	0.037	0.047**	0.045**	0.036	0.031*	0.031*	0.038	0.033	0.033*
and businessman	(0.026)	(0.020)	(0.019)	(0.028)	(0.019)	(0.019)	(0.028)	(0.020)	(0.018)
Library availability	0.061**	0.040	0.048	0.073	0.047*	0.046	0.012	−0.009	−0.008
	(0.024)	(0.068)	(0.061)	(0.043)	(0.028)	(0.028)	(0.044)	(0.032)	(0.029)
Nursery availability	0.075**	0.174***	0.166***	0.061***	0.067***	0.065***	0.024	0.039***	0.042***
	(0.028)	(0.039)	(0.035)	(0.018)	(0.013)	(0.013)	(0.016)	(0.014)	(0.014)
Constant	0.001	0.001	0.001	0.001	0.002**	0.002**	0.002	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	7072	7072	7072	7072	7072	7072	7072	7072	7027
R-squared	0.143	0.007	0.016	0.135	0.134	0.135	0.138	0.111	0.113
Underidentification		0.015	0.022		0.012	0.013		0.245	0.195
Overidentification		0.598	0.591		0.293	0.292		0.131	0.194
Weak identification		4.051	3.968		15.792	14.957		3.636	5.071

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively. Household consumption is used in logarithmic form. Local financial development (FD) is measured by $fd_{it}^{(\bullet)}$.

Table A3.5: The effect of local financial development on consumption smoothing

	District level			sub-district level			village level		
	OLS	hetero IV	all IV	OLS	hetero IV	all IV	OLS	hetero IV	all IV
FD	−0.232***	−0.495***	−0.504***	−0.315***	−0.339***	−0.380***	−0.308***	−0.358***	−0.390***
	(0.071)	(0.112)	(0.108)	(0.095)	(0.079)	(0.084)	(0.080)	(0.089)	(0.087)
Credit demand	0.054**	0.070***	0.073***	0.050*	0.045***	0.042***	0.047*	0.042***	0.045***
	(0.024)	(0.017)	(0.017)	(0.025)	(0.015)	(0.014)	(0.025)	(0.015)	(0.015)
FD*Credit demand	0.032	0.060*	0.060	−0.055	−0.047	−0.099	−0.133	−0.200***	−0.207***
	(0.066)	(0.037)	(0.036)	(0.120)	(0.079)	(0.067)	(0.107)	(0.047)	(0.050)
Production area(ha)	0.000	0.001*	0.002**	−0.001	−0.002***	−0.002***	−0.002	−0.002***	−0.002***
	(0.002)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Male	−0.043	−0.021	−0.036	−0.037	0.137	0.142	−0.049	−0.098	−0.166*
	(0.160)	(0.089)	(0.087)	(0.167)	(0.108)	(0.106)	(0.167)	(0.145)	(0.090)
Age	−0.004*	0.001	0.001	−0.008***	−0.009***	−0.009***	−0.007***	−0.007***	−0.006***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Disease	0.025	0.023**	0.022*	0.025	0.017	0.015	0.023	0.017**	0.021**
	(0.015)	(0.011)	(0.011)	(0.015)	(0.011)	(0.011)	(0.015)	(0.008)	(0.009)
Literate	0.016	0.034	0.043	0.019	0.040	0.041	0.018	0.065**	0.082***
	(0.034)	(0.029)	(0.027)	(0.035)	(0.026)	(0.026)	(0.035)	(0.027)	(0.025)
Married	0.024	0.066**	0.055**	0.034	0.031	0.036	0.021	0.041**	0.038*
	(0.040)	(0.027)	(0.024)	(0.037)	(0.030)	(0.030)	(0.038)	(0.020)	(0.020)
Kinh people	0.088	0.080**	0.093***	0.082	0.078*	0.072*	0.083	0.064*	0.075**
	(0.055)	(0.034)	(0.031)	(0.055)	(0.043)	(0.042)	(0.059)	(0.036)	(0.038)
HH nucleus size	−0.002	−0.000	0.001	−0.002	0.000	0.001	−0.003	−0.001	−0.002
	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)
Farmer	0.025	−0.008	−0.003	0.027	0.008	0.004	0.025	0.015	0.017
	(0.025)	(0.017)	(0.016)	(0.023)	(0.017)	(0.016)	(0.023)	(0.012)	(0.011)
Government officials	−0.058	−0.070***	−0.067***	−0.056	−0.083***	−0.078***	−0.054	−0.068**	−0.074***
and businessmen	(0.035)	(0.024)	(0.024)	(0.034)	(0.024)	(0.022)	(0.035)	(0.027)	(0.028)
Library availability	−0.016	−0.033***	−0.031***	−0.068*	−0.098***	−0.095***	−0.050	−0.062*	−0.067**
	(0.035)	(0.011)	(0.010)	(0.037)	(0.023)	(0.021)	(0.043)	(0.033)	(0.031)
Nursery availability	0.025	0.011	−0.003	0.039**	0.041***	0.041***	0.020	0.022*	0.021*
	(0.031)	(0.026)	(0.023)	(0.019)	(0.015)	(0.016)	(0.016)	(0.012)	(0.011)
Constant	0.000	0.000	0.001*	0.000	0.001	0.001*	0.000	0.001	0.001
	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	12321	12321	12321	12321	12321	12321	12321	12321	12231
R-squared	0.021	0.006	0.005	0.015	0.014	0.014	0.017	0.016	0.016
Underidentification		0.001	0.000		0.068	0.063		0.040	0.022
Overidentification		0.238	0.259		0.409	0.503		0.476	0.608
Weak identification		6.606	6.914		9.562	9.296		7.063	7.010

Notes: robust standard errors, clustered at the district level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively. Local financial development (FD) is measured by $fd_{it}^{(\bullet)}$.

3 Local financial development, corruption and firm growth in Vietnam

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Abstract. We examine the effects of province-level financial development and corruption on the performance of Vietnamese firms in terms of the growth rates of sales, investment and sales per worker. Employing a large firm level dataset of more than 40,000 firms spanning the period 2009—2013 and applying a heteroscedasticity-based identification strategy, we find that province-level financial development promotes firm growth while corruption hinders it. Moreover, financial development and corruption control are complementary to each other in their effects on firm growth. This suggests that while improving financial development or reducing corruption at the province level increases firm growth, the marginal effect of financial development is stronger when the level of corruption is low, and vice versa. We also find evidence of the 'too much finance' effect after controlling for the level of corruption. Our results are robust to the use of alternative measures of local financial development.

3.1 Introduction

The past three decades have witnessed extensive empirical research on the relationship between financial development and economic growth. Most studies document that financial development fosters economic growth (e.g., King and Levine, 1993; Rajan and Zingales, 1998 and Levine et al., 2000). However, there are also studies reporting that either causality runs from economic growth to financial development only (Ang and McKibbin, 2007), or the link between financial development and economic growth is weak and fragile (Andersen and Tarp, 2003). Similarly, Arcand et al. (2015) suggest that an intermediate level of financial depth promotes economic growth but the effect becomes negative if credit to the private sector exceeds 100% of GDP. Other studies document that the finance-growth nexus depends on other economic and institutional

factors such as the level of economic development, institutional quality, inflation, trade openness and financial globalization (e.g., Law et al., 2013; Herwartz and Walle, 2014a).

One of the institutional factors that are considered to affect the finance-growth relationship is corruption (Ahlin and Pang, 2008; Law et al., 2013). For instance, Law et al. (2013) construct an index of institutional quality based on corruption, rule of law and bureaucratic quality. Employing this index, they find that economies should reach a certain threshold level of institutional development before the impact of finance on growth becomes positive and significant. This evidence is also confirmed by Arcand et al. (2015) and corroborates the view that corruption in the financial system may redirect credit to unproductive or even wasteful projects (Ghirmay, 2004).

Unlike Law et al. (2013), Ahlin and Pang (2008) consider corruption as a factor affecting the finance-growth nexus in its own right, and not just as a proxy for institutional quality. They conjecture that financial development and corruption control are substitutes in their roles in promoting economic growth. This substitutability arises from the fact that corruption drives up the need for liquidity, thereby raising the importance of financial development while a lower level of financial development makes corruption more costly and hence increases the benefits from controlling corruption. Estimating a cross-country growth model, Ahlin and Pang (2008) find empirical support to their hypothesis that both financial development and corruption control have positive impacts on growth, and these factors act as substitutes in affecting economic growth. Examining Ahlin and Pang (2008)'s hypothesis at the micro level, Wang and You (2012) document that a high level of corruption promotes the growth of Chinese firms, and financial development and (high) corruption are substitutes. These results are in contrast to the cross-country results documented in Ahlin and Pang (2008) but support those of Law et al. (2013). Therefore, it remains unclear if the results in Wang and You (2012) are specific to Chinese firms, or if they represent a general micro-level relationship among corruption, financial development and firm growth in emerging economies or even worldwide.

In this study, we examine the joint effects of province-level financial development and corruption on firm growth in Vietnam. Three main reasons make Vietnam an interesting

country for conducting such a micro-level study. First, Vietnam as an emerging economy has exhibited rapid growth both in the real and financial sectors during the last three decades. In the 2000s, the GDP per capita increased at an average rate of 6.4 percent a year, which was among the fastest in the world (World Bank, 2016). Moreover, despite the uncertainties in the global economy such as financial crises, Vietnam has kept growing at a rate of more than 6 percent over the past decades and transformed itself from one of the poorest economies to a lower middle-income economy. Similarly, the financial sector has grown steadily since the government launched the renovation policy in the 1980s. Currently, the financial system is considered to be large for a lower middle-income country with total assets of nearly 200 per cent of GDP at the end of 2011 (World Bank, 2014).[10] Second, despite these achievements, the Vietnamese economy continues to be challenged by widespread corruption in all levels of the administrative structure. For instance, according to the Transparency International's Corruption Perception Index for the period 2009–2013, Vietnam was ranked between 112nd (in 2011) and 123rd (in 2012) out of 168 countries. The Vietnam Provincial Competitiveness Index (PCI) from 2009 to 2013 documents that petty corruption has become less frequent but macro corruption has worsened.[11] Third, while existing empirical studies on Vietnamese firms (e.g., O'Toole and Newman, 2017; Anwar and Nguyen, 2011; Rand and Tarp, 2012; Nguyen and Van Dijk, 2012) examine the finance-growth and corruption-growth relationships separately, none of them has considered the joint impacts of these factors

[10]In the 1980s, Vietnam implemented a renovation period and made the transition from a centrally planned economy to a market-oriented economy by launching the so-called *Doi moi* policy. This renovation has led to major reforms in the economic and financial sectors. Together with the establishment of state-owned commercial banks, the government allowed the operation of People's Credit Funds and foreign-owned banks. Moreover, Vietnam's equity market has grown with the setting up of the Ho Chi Minh Stock Exchange (in 2000) and the Hanoi Stock Exchange (2005) as well as the privatisation of many state-owned enterprises. These improvements are believed to have been crucial for the rapid economic growth the country has been witnessing since the 1990s (World Bank, 2014).

[11]From the 7th plenum of the Communist Party of Vietnam (CPV) in 1994, the General Secretary repeatedly considers corruption as a threat to the survival of the regime (Nguyen, 2016). For decades, the Vietnamese government has considered corruption as a national problem and the fight against corruption has received increasing public attention. Following the issuance of a new law on corruption in 2005, the National Anti-Corruption Committee was established in 2006 to monitor and handle corruption issues. However, progress in fighting corruption has remained modest and by international standards the state of corruption in Vietnam has not improved. Given the prevalence of corruption in Vietnam and the modest achievements in fighting it, the CPV and the government have repeatedly expressed their commitment to prevent and fight corruption at all levels of the administration.

on firm growth.

We employ a large firm-level panel data from the Vietnam Enterprise Survey covering more than 40,000 firms from 2009 to 2013. We measure financial development and corruption at the province level. Our main empirical strategy to identify the causal impacts of financial development and corruption on firm growth is the heteroscedasticity-based identification of Lewbel (2012). We find that province-level financial development has significant and positive effects on firm growth in terms of the growth rates of sales, investment and sales per worker. On the contrary, corruption negatively affects firm growth. Moreover, financial development and corruption control are complementary in their effects on firm growth. This suggests that while improving either financial development or corruption control at the province level could increase firm growth, the marginal effect of financial development is stronger when the degree of corruption is low, and vice versa. Our results also show that the effect of local financial development on firm growth is non-linear even after controlling for the level of corruption, which could be considered as a micro-level evidence in favor of the 'too much finance' hypothesis suggested by Arcand et al. (2015).

To put our results in the context of existing literature, it is noteworthy, on the one hand, that our results on the negative effect of corruption on firm growth are consistent with other firm-level studies for Vietnam (e.g., Tromme, 2016) and the cross-country evidence in Ahlin and Pang (2008) and Law et al. (2013). Yet, these results are contrary to Wang and You (2012), which document a positive impact of corruption on firm growth in China. On the other hand, our results on the complementarity between financial development and corruption control do not support the hypothesis of Ahlin and Pang (2008) and are rather in line with the macro-level evidence in Law et al. (2013) and the firm-level evidence in Wang and You (2012).

In Section 3.2, we briefly review studies on the finance-growth relationship, on the corruption-growth nexus and on the joint effect of financial development and corruption on economic growth. We provide descriptive statistics of the data in Section 3.3, and outline the estimation methodology in Section 3.4. In Section 3.5 we discuss the empirical results and provide robustness checks. Section 3.6 concludes. Further discussions on

methodology and robustness results are provided in Appendix 3.7.1 and 3.7.2.

3.2 Literature and hypotheses

In this section, we first briefly review the literature on the finance-growth nexus at the macro and micro levels. Next, we provide a review of the literature on the relationship between corruption control and economic growth. Subsequently, we review empirical studies on the joint impact of financial development and corruption on economic growth. We conclude this section by introducing three hypotheses that we will later subject to empirical testing.

3.2.1 The finance-growth nexus

The literature on the finance-growth relationship dates back to Schumpeter (1911), who emphasized that getting credit is an important prerequisite to becoming an entrepreneur. Several economists, such as McKinnon (1973), Shaw (1973), and Levine (2005), conjecture that financial development induces economic growth. They argue that the financial system provides several crucial growth-promoting functions. For instance, a developed financial sector mobilizes larger volumes of savings and more efficiently identifies high-return projects. It also allows economic agents to diversify intertemporal and cross-sectional risks. Furthermore, it facilitates the exchange of goods and services, thereby reducing transaction costs. Improvements in the way these functions are provided are expected to generate economic growth by raising the volume of financial resources available for investment and, most importantly, by enhancing the efficiency of resource allocation. However, there are some economists who argue that finance does not matter to economic growth. According to these economists, the financial system responds to the demand arising from the real sector, but not vice versa (Robinson, 1952). Some of them even question the very existence of a meaningful relationship between financial and economic development. For instance, Lucas (1988) argues, "the importance of financial matters is very badly over-stressed."

Empirically, most studies confirm that financial development fosters economic growth (e.g., King and Levine, 1993; Rajan and Zingales, 1998 and Levine et al., 2000).

However, studies such as Ang and McKibbin (2007) report that causality runs from economic growth to financial development only. Some studies even document that the link between financial development and economic growth is weak and fragile (Andersen and Tarp, 2003). More recent empirical works focus on uncovering determinants of the finance-growth relationhip. In particular, these studies document that the finance-growth relationship depends on the level of economic development, institutional quality, inflation, trade openness and financial globalization prevailing in an economy (e.g., Law et al., 2013; Herwartz and Walle, 2014a and Herwartz and Walle, 2014b). Similarly, Arcand et al. (2015) uncover a non-linear finance-growth relationship where the impact of finance on growth could even be negative at very high levels of financial development.

Most of the aforementioned studies consider financial development at the country level and investigate its relationship with economic growth using cross-country data. However, relatively less attention has been given to investigating the effects of within-country heterogeneity in financial development (e.g., at the province, district or commune levels) on local economic development. Among the few extant studies, Guiso et al. (2004) find that local financial development fosters firm growth in terms of increasing competition, favoring entry of new firms and reducing the rate of exit of old firms in Italy. Fafchamps and Schündeln (2013) explore the finance-growth relationship at a more aggregated level and report a positive effect of commune-level financial development on the performance of small and medium-sized firms in Morocco. Investigating the micro-level finance-growth nexus in Vietnam, Tran et al. (2018) document positive effects of local financial development (district-, sub-district- and village–level) on household's annual income, consumption and consumption smoothing.

3.2.2 The corruption–growth nexus

Corruption, which is defined as the sale by government officials of government property for personal gain (Shleifer and Vishny, 1993), is one of the persistent characteristics of human societies. Depending on their perspectives on the effect of corruption on economic growth, economists are generally divided into 'sanders' and 'greasers'. While 'sanders' argue that corruption (i.e., regulatory burden and delay) is a major obstacle to economic

development, 'greasers' emphasize that corruption fosters economic growth by mitigating distortions arising from inefficient institutions.

Among the 'sanders', Shleifer and Vishny (1993) illustrates that corruption impedes economic development because it weakens central governments and creates economic distortions. Based on a cross-country dataset, Mauro (1995) reports a negative impact of corruption on economic growth. Similarly, using three worldwide firm-level surveys, Kaufmann and Wei (1999) confirm that bribe payment and wasting time with bureaucrats increase the cost of capital. Similar evidence is documented in Ehrlich and Lui (1999) and Clarke (2011). While most of the above studies consider corruption at the country level, a few studies have also examined the effects of paying bribes on firm performance. For instance, Fisman and Svensson (2007) find that bribe payments reduces firm growth in Uganda. Focusing on Vietnamese firms, Rand and Tarp (2012) find that bribe payments have a negative impact on firm growth. Recently, the *Journal of Crime, Law, and Social Change* published a *Special Issue* on the state and consequences of corruption in Vietnam (Tromme, 2016). These papers document that corruption has a generally adverse effect on economic growth in Vietnam.

However, there are other economists ('greasers') who believe that corruption fosters economic growth. For instance, Leff (1964), Leys (1965) and Huntington (1968) suggest that corruption may foster growth by alleviating the distortions of inefficient governance institutions. Lui (1985) shows that paying for corruption may help to reduce the time cost of delay. The 'grease the wheels' argument implies that an inefficient governance would be a major obstacle to economic growth and corruption could help to overcome the delay. Using a general equilibrium approach, Acemoglu and Verdier (1998) find that it may be optimal to allow some level of corruption and lower levels of property rights, especially for less developed economies. In support of this hypothesis, Wang and You (2012) document that a high level of corruption promotes the growth of Chinese firms. However, Méon and Weill (2010) report that the effects of corruption on efficiency depend on the level of effectiveness of institutions. For instance, corruption is less detrimental to efficiency in countries with deficient institutional frameworks and could even be positively associated with efficiency in countries with extremely ineffective institutions.

3.2.3 Financial development, corruption and economic growth

While most of the aforementioned studies provide empirical evidence on the separate effects of financial development and corruption on economic growth, they do not examine the joint effects of these two factors on economic growth. As an exception, Ahlin and Pang (2008) thoroughly examine the relationship among financial development, corruption and growth. In particular, they conjecture that financial development and corruption control are substitutes in their effects on firm growth. This substitutability arises from the fact that corruption drives up the need for liquidity, thereby raising the importance of financial development. Similarly, a lower level of financial development makes corruption more costly and hence increases the benefits from controlling corruption. To empirically test this hypothesis of substitutability between financial development and corruption control, they introduce the interaction between financial development and corruption in a standard growth model. In support of their hypothesis, they find that while both financial development and corruption control have positive impacts on growth, these factors act as substitutes in affecting economic growth.

To examine if the finance-growth nexus depends on the level of a country's institutional setup, Law et al. (2013) also investigate, albeit indirectly, the joint impact of financial development and corruption on economic growth. The authors construct an index of institutional quality based on corruption, rule of law and bureaucratic quality. Employing this index, they find that the impact of finance on growth is nonexistent when institutional quality is low. Instead, economies should reach a certain threshold level of institutional development so that the impact of finance on growth becomes positive and significant. This evidence is also confirmed by Arcand et al. (2015) and corroborates the view that corruption in the financial system may draw credit away from viable projects and redirect it to unproductive or even wasteful activities (Ghirmay, 2004).

Examining Ahlin and Pang (2008)'s hypothesis at the micro level, Wang and You (2012) document that a high level of corruption promotes the growth of Chinese firms, and that financial development and (high) corruption are substitutes. These results are in sharp contrast to the cross-country results documented in Ahlin and Pang (2008). However, it remains unclear if the results in Wang and You (2012) are specific to Chinese

firms, or if they represent the firm-level corruption-firm growth relationship in emerging economies or even worldwide.

Focusing on the channels through which corruption affects economic growth, Mo (2001) provides evidence that corruption impacts negatively on non-performing loans. Similarly, Kunieda et al. (2016) report that corruption has both a direct negative impact on economic growth and an indirect negative impact on financial development. In contrast to the results in Ahlin and Pang (2008), Batabyal and Chowdhury (2015) find that higher rates of corruption crowded out the return to financial development in 30 Commonwealth countries over the period 1995–2008. This suggests the complementary effects of policies that simultaneously reduce corruption and promote financial development. Namely, reducing corruption and simultaneously promoting financial development have a bigger impact in reducing income inequality than implementing one of these two policies. With respect to the reverse causality from firm growth to corruption, Bai et al. (2017) find that firm growth reduces bribes as a share of revenue in Vietnam. The effects are higher for mobile firms, which have transferable land rights and operate in multiple provinces.

3.2.4 Hypotheses

Existing macro- and micro-level empirical studies that examine if financial development and corruption are substitutes or complements in their impacts on economic growth have documented inconclusive results. In this paper, we re-examine the issue using a large firm-level dataset from Vietnam spanning the period 2009–2013. Based on the above literature review and the fact that more than 90% of the firms in our dataset are small firms, which are likely to be highly affected by financial constraints and corruption, we make the following three hypotheses:

Hypothesis 1 (H_1): Local financial development promotes firm growth in Vietnam. This hypothesis is in line with most of the empirical literature on the role of local financial development on economic growth (e.g., Fafchamps and Schündeln, 2013; Guiso et al., 2004; Tran et al., 2018).

Hypothesis 2 (H_2): Firms in provinces with a higher level of corruption grow slower than

firms in low-corruption provinces. Given that several studies have reported a generally negative impact of corruption on Vietnamese economic growth (e.g., Tromme, 2016), we expect the same relationship to exist in our dataset.

Hypothesis 3 (H_3): Financial development and corruption control are complementary in their effects on firm growth. That is, in contrast to Ahlin and Pang (2008)'s hypothesis, but consistent with the evidence in Law et al. (2013), we conjecture that the impact of financial development on firm growth is likely to be stronger in provinces with a lower level of corruption.

Remark : Although H_3 is in line with the firm-level evidence for China (Wang and You, 2012), it is noteworthy that the latter's results are against H_2. However, given that existing studies for Vietnam have consistently documented a negative impact of corruption on growth, we expect our results to be in line with both H_2 and H_3.

3.3 Data

In this section, we provide summary statistics for variables used in this study, including the indicators for firm growth and province-level financial development, indices for province-level corruption, and firm-and province-level characteristics.

Panel A of Table 3.1 provides information on the firm level characteristics. The firm-level data are obtained from the Vietnam Enterprise Survey (VES), which is a nationally representative annual survey conducted by the General Statistics Office (GSO) of Vietnam. Firm growth is measured by annual growth rates of sales per worker, investment and sales from 2010 to 2013. On average, sales per worker grows at 19.3% annually while investment and sales grow at 20.6% and 17.9%, respectively. [12] To minimize risks of endogeneity, all of our explanatory variables are lagged by one period, and hence are measured for the years 2009 to 2012. Annually, firms have average sales per worker of more than 1 billion VND; a representative firm invests about 6.8

[12]It is noteworthy that the data are not deflated. Hence, with an an average annual inflation rate of about 8.4% for the period under consideration, real growth rates in sales per worker, investment and sales are around 2.3%, 2.5% and 2.1%, respectively. As scaling both the dependent and explanatory variables by the consumer price index leaves results reported in this paper largely unaffected, we proceed with nominal variables following the empirical literature using the VES data (e.g., Nguyen and Van Dijk, 2012, O'Toole and Newman, 2017). Results using price-deflated variables are available upon request.

billion VND and receives sales revenue of about 7.6 billion VND. On average, firms have about 8 employees, which is consistent with the fact that more than 90% of Vietnamese firms are micro and small enterprises. Moreover, firms possess average assets worth about 11 billion VND. About 33.8% of the firms are purely private owned, and hence are not even partially owned by foreigners or the government.

Panel B of Table 3.1 documents province-level characteristics. On average, each province has about 2.5 financial suppliers per 100,000 people or per 100 square kilometre. The province with the largest number of financial suppliers per capita has about 12.7 financial suppliers per 100,000 people and the province with the highest density of financial suppliers has about 43 financial suppliers per 100 square kilometre. We will use the number of financial suppliers per capita as our main measure of local financial development and the number of financial suppliers per square kilometre for robustness checks. The average province-level population density is about 567 people per square kilometre. Moreover, the average per capita income is about 29 million VND.

Panel C documents information about informal charges and corruption at the province level. This information is obtained from the Province Competitive Index (PCI) survey, which is conducted annually by the Vietnam Chamber of Commerce and Industry (VCCI) and the US Agency of International Development (USAID). This survey is based on a representative sample of enterprises and ranks the provinces in terms of the prevailing business environment. In the following, we describe the so-called low informal charges index of the VCCI together with the four sub-indices which make up the composite index.

Regularly paying informal charges (Sub1): This index measures the ratio of enterprises that believe that other enterprises in their sector have paid for informal costs. On average, 54.9% of enterprises confirm this fact, with the highest and lowest rates per province being 77.5% and 26%, respectively. A province with a higher rate of firms reporting others in the same sector pay informal charges is considered to have a higher level of corruption.

Paying more than 10% of income for informal charges (Sub2): This index measures how many percent of the firms pay more than 10% of their income for informal costs. On

average about 7% of enterprises have paid more than 10% of their income for informal costs, with province-level ratios ranging from 1.2% to 18.8%. This ratio is expected to be highly correlated with corruption and is seen as a burden for firm growth.

Prevalence of harassment (Sub3): This index reports the percentage of firms stating that government officials use compliance with local regulations to extract informal payments from businesses like theirs. It is expected that the higher this ratio is, the more serious is the problem of corruption at the local level. In fact, 45.9% of the firms confirm that they experienced harassment from local authorities and this ratio differs widely among provinces, with the minimum and maximum ratios being 18% and 73.1%.

Better services after paying informal charges (Sub4): This index provides information related to the behaviour of local officials after receiving informal charges from firms. As documented in Panel C of Table 3.1, more than 56% of the firms state that they get better services from local authorities after paying for informal charges. Among provinces, the lowest rate is about 24.8% while the highest rate is 81%. This underscores the fact that, although corruption is a cost to firms, it could also be considered as a lubricant in facilitating business activities (i.e., a kind of 'speed money', Mauro, 1995; or 'grease money', Kaufmann and Wei, 1999.)

Informal charges (IC): In order to rank the provinces according to prevailing business environment, the VCCI have combined the above four indicators and constructed the so-called low informal charges index.[13] The low informal charges index is given on a scale from 1 to 10, with 1 and 10 representing the least and most favourable business environments, respectively. However, as our interest lies in the level of corruption, and not the business environment, we reverse the low informal charges index by subtracting it from 11. As a result, our informal charges (IC) index takes on values from 1 to 10, with the larger numbers representing a higher level of corruption. It can be seen in Panel C of Table 3.1 that the average IC per province is 4.5, and individual indices range from 2.38 to 6.43.

[13]For more details, see http://eng.pcivietnam.org/.

Table 3.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: Firm-level characteristics					
Growth of sales per worker	143,683	0.193	1.448	-9.585	12.751
Investment growth	140,561	0.206	1.506	-11.777	13.197
Sales growth	143,724	0.179	1.433	-10.303	13.260
Sales per worker$^{(a)}$	148,527	1.038	3.785	0	284.381
Investment$^{(a)}$	154,031	6.810	24.620	0	906.078
Sales$^{(a)}$	152,322	7.618	26.614	0	906.078
Labour	154,276	7.934	6.962	1	335
Asset$^{(a)}$	154,269	10.926	41.020	0	3,714.134
Private	154,277	0.338	0.473	0	1
Panel B: Provincial characteristics					
Number of FS per 1000 capita (FD1)	162	0.025	0.025	0.001	0.127
Number of FS per km2 (FD2)	162	0.025	0.061	0.000	0.429
Population density at province (1000 per km2)	164	0.567	0.624	0.082	3.656
Provincial per capita income$^{(b)}$	164	29.292	38.616	9.329	327.194
Panel C: Provincial informal charges and corruption indices					
Regularly paying informal charges ($Sub1$)	164	0.549	0.115	0.260	0.775
Paying more than 10% of income for informal charges ($Sub2$)	164	0.070	0.034	0.012	0.188
Prevalence of harassment ($Sub3$)	164	0.459	0.128	0.180	0.731
Better services after paying informal charges ($Sub4$)	164	0.562	0.101	0.248	0.810
Informal charges (IC)	164	4.503	0.924	2.380	6.431

Notes: All growth rates are computed as differences in natural logarithms of annual sales, sales per worker and investment for the years 2010 to 2013. The remaining firm level and province level characteristics are lagged values, i.e., measured from 2009 to 2012. The superscripts $^{(a)}$ and $^{(b)}$ indicate variables that are measured in billion and million VND, respectively.

Table 3.2: Correlation of corruption indices

	IC	*Sub1*	*Sub2*	*Sub3*	*Sub4*
IC	1				
Sub1	0.819*	1			
Sub2	0.492*	0.321*	1		
Sub3	0.851*	0.792*	0.398*	1	
Sub4	-0.089	0.242*	0.095	0.169	1

Note: (*) indicates significance at the 1% level.

3.4 Identification strategy

In order to identify the effects of local financial development, corruption and their interaction on firm growth, we estimate the following model:

$$\begin{aligned}\Delta Y_{fi,t} = \alpha_0 + \alpha_1 FD_{i,t-1} + \alpha_2 Corruption_{i,t-1} + \alpha_3 FD_{i,t-1} * Corruption_{i,t-1} + \\ + \alpha_4 {FD^2}_{i,t-1} + \alpha_5 Corruption^2_{i,t-1} + \alpha_6 Y_{fi,t-1} + X_{fi,t-1}\boldsymbol{\beta} + \epsilon_{fi,t},\end{aligned} \tag{3.1}$$

where $\Delta Y_{fi,t}$ represents a measure of growth (growth of sales per worker, investment and sales) of firm f at province i from year $t-1$ to year t; $FD_{i,t}$ and $Corruption_{i,t}$ represent indices of province-level financial development and corruption, respectively. $Y_{fi,t-1}$ is included to account for effects of initial conditions. The vector $X_{fi,t-1}$ stacks all other firm and local characteristics and $\epsilon_{fi,t}$ is the error term. As an indicator of corruption, we employ the informal charges (IC) index, which is directly related to the level of corruption in the province and is used in previous studies (Nguyen and Van Dijk, 2012; Rand and Tarp, 2012).

Following Ahlin and Pang (2008), who use cross-country data to examine the complementarity in the effects of financial development and corruption on growth, we investigate the effects of province-level financial development, corruption and their interaction on the growth of Vietnamese firms in terms of the growth rates of sales, sales per worker and investment from 2009 to 2013. We hypothesize that local financial development affects firm growth positively (H_1: α_1 is positive) while corruption affects it negatively (H_2: α_2 is negative). Moreover, we expect that financial development and corruption control are complementary in their effects on firm growth (H_3: α_3 is negative) such that financial development shows stronger effect on firm growth in province with lower level of corruption.

Following Ahlin and Pang (2008), we include the squares of local financial development and corruption indices in our regression model to account for the possibility that the interaction effect may be due to some kind of non-linearity in the effects of financial development or corruption indices. Interestingly, this also allows examining the 'too much finance' hypothesis (Arcand et al., 2015), which conjectures that financial development could have a negative effect on growth once it reaches a certain threshold level (α_4 is negative).

Studies on the impact of local financial development on firm growth may suffer from endogeneity issues as firm growth may cause financial development at the local level. At both macro and micro levels, potential reverse causality from economic development to financial development has been considered as a serious challenge in investigating the finance-growth nexus. Obviously, this problem is less serious at the micro level since

growth of individual firms—unlike local economic development—is less likely to affect financial development at a regional level. Still, to address any potential endogeneity problem, one may rely on the use of Generalized Method of Moments (GMM) based estimators for dynamic panel data, which have been suggested by Arellano and Bond (1991) and Blundell and Bond (1998). However, these methods are not appropriate for our study as our panel spans only four years. Alternatively, a widely used method to identify causal relationships is to use external instruments, which unfortunately requires strong conditions that make it often difficult to find appropriate instruments in practice. For instance, at the macro level, Levine et al. (2000) introduce institutional variables such as legal origin as instruments for financial development and they have been widely used in several studies thereafter. However, these instruments are not applicable for our analysis as there are few institutional differences among Vietnamese provinces.

To deal with any potential endogeneity problem in estimating the model in (3.1), we employ the identification method proposed by Lewbel (2012), which is built upon an earlier work by Rigobon (2003). Lewbel (2012) suggests identification by means of internal instruments without imposing any exclusion restriction. This method exploits the correlation between heteroscedastic disturbances of the model and exogenous variables to generate internal instruments. Hence, we instrument financial development, its squared term and its interaction with corruption indices by means of heteroscedasticity-based instruments. A brief description of this procedure is provided in Appendix 3.7.1.

To apply this method on our panel data, we follow the procedure suggested by Baum and Schaffer (2012), which involves eliminating firm-specific fixed effects by means of the within transformation and applying the estimation method suggested by Lewbel (2012) on this transformed data.[14]

3.5 Model diagnostics and empirical results

In this section, we provide empirical results on the effects of province-level financial development, corruption and their interaction on firm growth. We first present model

[14]In this study, we use the Stata package *ivreg2h* (Baum and Schaffer, 2012).

diagnostics, which highlight the suitability of our model and estimation strategy to test our three hypotheses that financial development promotes firm growth (H_1), corruption hinders firm growth (H_2), and financial development and corruption control are complementary in their effects on firm growth (H_3). Subsequently, we discuss empirical results regarding our three hypotheses. Finally, we provide some robustness results to show that our main findings remain unchanged if we employ alternative measures of local financial development or corruption. Throughout, the discussion of empirical results refers to the 5% nominal significance level.

3.5.1 Model diagnostics

Tables 3.3 and 3.4 document our baseline results obtained from estimating equation (3.1) using informal charges (IC) as a measure of corruption. The heteroscedasticity-based identification relies on the assumption that there exist correlations between the exogeneous variables of the model and variances of residuals obtained by regressing endogeneous variables on the exogeneous variables of the model. While it is not straightforward to test if this assumption holds, standard tests of instrument validity could indicate indirectly the suitability of our heteroscedasticity-based instruments. Model diagnostics for tests of overidentification and weak identification are provided in the bottom rows of both tables. The reported test results show that both the overidentification and the weak identification tests support all the IV specifications. Hence, the specification tests support the heteroscedasticity-based identification strategy.

With respect to the control variables, results show significant and positive impacts of labour and assets of a firm on the growth rates of investment, sales and sales per worker. Moreover, the statistically significant and negative coefficients of the initial levels of investment, sales and sales per worker are consistent with the literature which documents that smaller firms grow faster than large firms (e.g., Evans, 1987; Hall, 1987). The results also document that private firms have lower rates of growth in terms of sales per worker but higher rates of investment growth when compared with firms owned by the government or foreigners. This effect, however, lacks significance when firm growth is

measured by the growth rates of sales.

Provincial per capita income has a positive impact on the growth rate of sales per worker, but it has a negative impact on the growth rate of sales and an insignificant impact on investment growth. While the negative impact of regional economic development on the growth rate of total sales might reflect the degree of competition in richer provinces, the positive impact on sales per worker might indicate the increased efficiency due to enhanced competition.

In general, the model diagnostics support our estimation strategy and control variables have expected effects on firm growth. In the following, we discuss if our results support the hypotheses H_1 to H_3.

3.5.2 Effects of local financial development and informal charges on firm growth

Table 3.3 shows the effects of province-level financial development, informal charges and their interaction on the growth rate of sales per worker. Specifications (1), (2) and (3) provide results obtained without controlling for the non-linear effects of financial development and corruption while specifications (4) and (5) control for these impacts. While all specifications report results obtained by using the heteroscedasticity-based IV estimation, they differ in the variable which is assumed to be endogeneous: financial development in (1) and (4), corruption in (2) and (5), and both financial development and corruption in (3).

The results documented in Table 3.3 reveal that province-level financial development has a positive impact on the growth rate of sales per worker in all specifications, which is consistent with our first hypothesis (H_1). This result is also in line with most of the empirical literature on the role of local financial development on economic growth (e.g., Fafchamps and Schündeln, 2013; Guiso et al., 2004; Tran et al., 2018).

Paying for informal charges shows a significantly negative impact on the growth rate of sales per worker in all the specifications. These IV-based results support the second hypothesis (H_2) and are in agreement with the literature on the effects of corruption on economic growth in Vietnam (e.g., Tromme, 2016). However, our results are in contrast

to the findings in Wang and You (2012), who document that a high level of corruption promotes the growth of firms in China.

Table 3.3 also shows that—in line with (H_3)—the interaction between financial development and corruption (IC) has a significantly negative impact on the growth rate of sales per worker in all the specifications. Hence, we conclude that province-level financial development and corruption control (low corruption) are complementary in promoting the growth rate of sales per worker. These results are in contrast to the cross-country results in Ahlin and Pang (2008), but similar to the firm-level evidence in Wang and You (2012). Our results are also in line with the macro-level evidence by Law et al. (2013), who document that better institutions (of which lower corruption is one) increase the growth-promoting role of financial development.

Results in specifications (4) and (5) of Table 3.3 show that the negative effect of the interaction between local financial development and corruption on the growth of sales per worker weakens in magnitude but remains statistically significant when non-linearities in the impacts of financial development and corruption are taken into account. The non-linear effects are also interesting in their own right. As shown in column (4) the square of province-level financial development has a significantly negative impact on the growth of sales per worker. This supports the findings in Arcand et al. (2015) that the effect of financial development on economic growth could become negative once the level of financial development reaches a certain threshold level. Results in column (5) of Table 3.3 show that the level of corruption exerts a significantly negative non-linear effect on firm growth. This implies that a unit change in the level of corruption has a more pronounced negative effect on firm growth when the level of corruption is high.

Table 3.3: The effects on growth rate of sales per worker

	heteroscedasticity-based identification				
	Endogeneity			Endogeneity and non-linearity	
	FD	IC	FD and IC	FD	IC
	(1)	(2)	(3)	(4)	(5)
FD1	0.337***	0.145***	0.344***	0.204***	0.112***
	(0.021)	(0.014)	(0.019)	(0.011)	(0.010)
Informal charges (IC)	−0.081***	−0.058***	−0.052***	−0.084***	−0.070***
	(0.010)	(0.018)	(0.014)	(0.004)	(0.008)
FD1*IC	−0.202***	−0.058***	−0.096***	−0.161***	−0.139***
	(0.020)	(0.017)	(0.014)	(0.010)	(0.018)
Initial	−1.039***	−1.040***	−1.040***	−1.039***	−1.039***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Labour	0.060***	0.058***	0.058***	0.059***	0.059***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Asset	0.002*	0.004***	0.001	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private	−0.035	−0.054***	−0.057***	−0.047***	−0.044***
	(0.022)	(0.020)	(0.017)	(0.010)	(0.015)
Provincial per capita income	0.003***	0.003***	0.004***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year2010	0.057***	0.102***	0.039***	0.083***	0.099***
	(0.012)	(0.016)	(0.011)	(0.009)	(0.011)
Year2011	−0.063***	−0.023	−0.072***	−0.052***	−0.020*
	(0.014)	(0.024)	(0.014)	(0.011)	(0.012)
Year2012	−0.083***	−0.024	−0.110***	−0.053***	−0.027**
	(0.015)	(0.020)	(0.010)	(0.014)	(0.012)
FD12				−0.029***	
				(0.010)	
IC2					−0.039***
					(0.006)
Constant	−0.008***	−0.000	−0.001	−0.005***	0.009***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	135321	135321	135321	135321	135321
R-squared	0.577	0.578	0.577	0.578	0.578
Overidentification	0.149	0.071	0.116	0.235	0.325
Weak identification	80.475	68.141	84.407	367.925	128.992
Differentials in growth rates					
IC at 25th, FD increases	−0.428	−0.077	−0.030	−0.182	−0.407
IC at 75th, FD increases	−0.661	−0.144	−0.141	−0.368	−0.568
Difference	0.234	0.067	0.111	0.186	0.161

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variable is annual growth rate of sales per worker and measured from 2010 to 2013. All explanatory variables are measured from 2009 to 2012. 'IC2' and 'FD12' denote the squares of informal charges and province-level financial development, respectively. The overidentification test is based on the Hansen J test with the null hypothesis being all instruments are valid. Reported values for overidentification are p-values. For weak identification, Kleibergen-Paap rk Wald F statistics are reported. 'FD increases' in the bottom panel refers to the change in the level of local financial development from the 25th to the 75th percentile.

The bottom panel of Table 3.3 documents the differentials in growth rates that arise if either local financial development or the corruption index changes from the 25th to the 75th percentile. Owing to the large negative interaction effects, the positive contribution of financial development to firm growth is often offset by its role in exacerbating the negative effect of corruption in firm growth. In general, consistent with H_3, the effect of increasing financial development has larger growth effects (or smaller negative effects) when the level of corruption is low (at the 25th percentile) than when it is high (75th percentile). For instance, in specification (3), increasing financial development from the 25th to the 75th percentile decreases the growth rate of sales per worker by 3.0 and 14.1 percentage points when province-level corruption is at the 75th and the 25th percentiles, respectively, which yields a growth differential of 11.1 percentage points.[15]

Table 3.4 documents results on the effects of financial development and corruption on the growth rates of total sales. In particular, province-level financial development promotes the growth of sales in all but one of the specifications (supporting H_1). On the other hand, corruption (IC) shows a significantly negative impact on sales growth (supporting H_2). Moreover, we find that the interaction between province-level financial development and corruption has a negative impact on the growth rate of sales. However, this impact is not statistically significant when financial development is not treated as an endogeneous variable (specifications (2) and (5)). Supporting H_3, the negative coefficient on the interaction term between financial development and corruption implies that the two determinants have substitution effects on sales growth (i.e., financial development and corruption control have complementary effects). Again, as in the case of sales per worker (3.3), the interaction effect weakens when non-linearities in the impacts of financial development and corruption are taken into account. Unlike the evidence in Table 3.3, however, results in specification (4) and (5) of Table 3.4 show that the non-linear impacts of local financial development and corruption on firm growth are not statistically significant.

[15]Note that the same growth differential of 11.1 percentage points is obtained if we reverse the roles of financial development and corruption, i.e., decrease the level of corruption while holding financial development, first at the 75th and then at the 25th percentile.

Table 3.4: The effects on growth rate of sales

	heteroscedasticity-based identification				
	Endogeneity			Endogeneity and non-linearity	
	FD	IC	FD and IC	FD	IC
	(1)	(2)	(3)	(4)	(5)
FD1	0.143***	0.039**	0.154***	0.084***	0.010
	(0.023)	(0.016)	(0.025)	(0.010)	(0.008)
Informal charges (IC)	−0.053***	−0.032*	−0.029*	−0.052***	−0.036***
	(0.010)	(0.017)	(0.015)	(0.004)	(0.006)
FD1*IC	−0.129***	−0.033	−0.047**	−0.114***	−0.009
	(0.028)	(0.022)	(0.020)	(0.017)	(0.029)
Initial	−0.978***	−0.978***	−0.977***	−0.978***	−0.975***
	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)
Labour	0.118***	0.117***	0.116***	0.117***	0.115***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)
Asset	−0.001	0.002***	0.000	0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private	0.003	−0.001	0.002	0.003	−0.021
	(0.020)	(0.015)	(0.014)	(0.016)	(0.015)
Provincial per capita income	−0.001**	−0.001	−0.001**	−0.001***	−0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Year2010	0.143***	0.170***	0.135***	0.160***	0.170***
	(0.014)	(0.016)	(0.011)	(0.007)	(0.008)
Year2011	0.045***	0.073***	0.054***	0.054***	0.067***
	(0.012)	(0.018)	(0.012)	(0.007)	(0.009)
Year2012	−0.012	0.029**	−0.012	0.005	0.030***
	(0.013)	(0.014)	(0.013)	(0.010)	(0.009)
FD12				−0.019	
				(0.012)	
IC2					0.001
					(0.005)
Constant	−0.002	0.003**	0.003**	−0.001	0.005***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Observations	135368	135368	135368	135368	135368
R-squared	0.543	0.543	0.543	0.543	0.543
Overidentification	0.094	0.269	0.159	0.222	0.397
Weak identification	117.231	59.017	51.187	564.794	110.739
Differentials in growth rates					
IC at 25th, FD increases	−0.341	−0.085	−0.028	−0.197	−0.024
IC at 75th, FD increases	−0.490	−0.123	−0.083	−0.329	−0.034
Difference	0.149	0.038	0.054	0.132	0.010

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variables are annual growth rates of investment and sales, which are measured from 2010 to 2013. 'Initial' denotes the level of sales in the previous year. For further notes see Table 3.3.

Table 3.5: The effects on growth rate of investment

	heteroscedasticity-based identification				
	Endogeneity			Endogeneity and non-linearity	
	FD	IC	FD and IC	FD	IC
	(1)	(2)	(3)	(4)	(5)
FD1	0.148***	0.028*	0.125***	0.073***	0.014
	(0.021)	(0.016)	(0.024)	(0.011)	(0.010)
Informal charges (IC)	−0.043***	−0.026*	−0.030**	−0.048***	−0.036***
	(0.008)	(0.015)	(0.013)	(0.005)	(0.006)
FD1*IC	−0.152***	−0.083***	−0.072***	−0.132***	−0.074**
	(0.025)	(0.021)	(0.020)	(0.018)	(0.029)
Initial	−0.986***	−0.985***	−0.985***	−0.984***	−0.982***
	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Labour	0.137***	0.136***	0.136***	0.136***	0.132***
	(0.002)	(0.003)	(0.002)	(0.001)	(0.002)
Asset	−0.000	0.003**	0.002*	0.001*	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private	0.038*	0.030*	0.029	0.051***	0.025*
	(0.020)	(0.018)	(0.018)	(0.014)	(0.013)
Provincial per capita income	−0.000	0.000	−0.000	−0.000	0.000
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Year2010	0.075***	0.112***	0.075***	0.086***	0.100***
	(0.011)	(0.017)	(0.009)	(0.007)	(0.009)
Year2011	0.053***	0.088***	0.063***	0.057***	0.075***
	(0.010)	(0.018)	(0.009)	(0.008)	(0.008)
Year2012	0.139***	0.187***	0.149***	0.156***	0.177***
	(0.013)	(0.016)	(0.010)	(0.012)	(0.009)
FD12				−0.048***	
				(0.011)	
IC2					−0.005
					(0.005)
Constant	−0.008***	−0.004***	−0.003**	−0.004***	−0.001
	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)
Observations	132108	132108	132108	132108	132108
R-squared	0.523	0.524	0.523	0.524	0.524
Overidentification	0.109	0.144	0.131	0.154	0.280
Weak identification	109.542	58.417	53.774	585.939	126.983
Differentials in growth rates					
IC at 25th, FD increases	−0.421	−0.280	−0.148	−0.054	−0.260
IC at 75th, FD increases	−0.597	−0.375	−0.231	−0.207	−0.345
Difference	0.176	0.096	0.083	0.153	0.086

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variables are annual growth rates of investment and sales, which are measured from 2010 to 2013. 'Initial' denotes the level of investment in the previous year. For further notes see Table 3.3.

Table 3.5 documents estimation results on the effects of financial development

and corruption on investment growth. These results are qualitatively similar to those in Tables 3.3 and 3.4. In particular, province-level financial development promotes investment growth in all but one of the specifications (supporting H_1) while corruption (IC) shows a significantly negative impact on investment growth throughout the specifications. Moreover, (supporting H_3) the interaction between province-level financial development and corruption has a significantly negative impact on investment growth. However, as in Tables 3.3 and 3.4, the negative effect of the interaction between financial development and corruption on investment growth—albeit being marginally weaker—remains statistically significant even after accounting for the non-linear impacts of financial development and corruption.

In sum, empirical evidence documented in Tables 3.3, 3.4 and 3.5 support our three hypotheses. The results imply that either promoting province-level financial development or reducing the prevalence of paying informal charges is associated with firm growth in terms of the growth rates of investment, sales and sales per worker. Moreover, the marginal impact of improving along one dimension (say, financial development) is bigger when the other dimension (say, corruption control) is at a higher level.

3.5.3 An alternative measure of local financial development

To further check the robustness of our baseline results, which are obtained using the number of financial suppliers per 1000 capita as an indicator of local financial development, we alternatively measure province-level financial development by means of the number of financial suppliers per square kilometre. These results are provided in Appendix 3.7 and are qualitatively similar to our baseline results.[16] In particular, the results reveal that province-level financial development promotes firm growth while corruption hinders it (H_1, H_2). Moreover, financial development and corruption control are complementary to each other in their effects on firm growth (H_3). These robustness check results also confirm the non-linear effect of province-level financial development on firm growth.

[16]Note that these two financial development indicators have a positive correlation coefficient of more than 0.8, which is significant at the 1 percent level.

3.6 Conclusions

In this paper, we examined the effects of province-level financial development, corruption and their interaction on firm growth in terms of the growth rates of sales per worker, investment and sales. Employing a large firm level data of more than 40,000 firms spanning the period 2009—2013 and applying a heteroscedasticity-based identification strategy, we find that province-level financial development has a positive effect on firm growth while corruption has a negative impact. Moreover, financial development and corruption control are complementary to each other in their effects on firm growth. The complementary effect shows that the marginal effect of financial development is stronger when the level of corruption control is high, and vice versa. This result also implies that firms in provinces with a higher level of financial development suffer more from the difficulties posed by corruption than firms in provinces with a lower level of financial development. This evidence is in line with the view that corruption in the financial system may divert credit to unproductive or even wasteful projects (Ghirmay, 2004).

This study also provides a micro-level empirical support for the 'too much finance' hypothesis in Arcand et al. (2015). In particular, our results show that the effect of local financial development on firm growth is non-linear even after controlling for the level of corruption. This implies that the marginal effect of province-level financial development on firm growth diminishes with increasing local financial development. With respect to the non-linear effect of corruption on firm growth, our results imply that a unit change in the level of corruption has a more pronounced negative effect on firm growth when the level of corruption is high.

In our robustness checks, we find that our results remain qualitatively unchanged and robust to measuring local financial development by means of the number of financial suppliers per square kilometre instead of using the number of financial suppliers per 1000 capita.

One of the province-level factors that potentially affect firm growth is the level of infrastructural development. Hence, in a future study, it is worthwhile examining if province-level infrastructural development, financial development and corruption control are substitutes in their roles in firm growth.

3.7 Appendix for study 2

3.7.1 A brief description of heteroscedasticity-based identification strategy

To provide a brief description of the heteroscedasticity-based identification strategy proposed by Lewbel (2012), we begin by re-writing our model of interest in (5.3) as

$$Y_1 = X\boldsymbol{\beta_1} + Y_2\gamma_1 + U, \tag{3.2}$$

where Y_1 is the dependent variable, vectors X and Y_2 denote, respectively, the set of endogeneous and exogeneous explanatory variables, and U is the error term. Assume also that the endogeneous variable Y_2 is given by

$$Y_2 = X\boldsymbol{\beta_2} + Y_1\gamma_2 + V. \tag{3.3}$$

As usual, the structural error terms in models (3.2) and (3.3) are assumed to be independent from each other and from the explanatory variables X. The heteroscedasticity-based identification strategy, however, assumes additionally that there exists heteroscedasticity in V (and hence Y_2). Hence, while the usual assumptions are

$$\mathrm{Cov}(X, U) = \mathrm{Cov}(X, V) = \mathrm{Cov}(X, UV) = 0,$$

heteroscedasticity-based identification additionally assumes that

$$\mathrm{Cov}(X, V^2) \neq 0.$$

To perform a heteroscedasticity-based instrumental variable estimation of (3.2), Lewbel (2012) suggests to instrument Y_2 by $[X - \mathrm{E}(X)]\hat{V}$, where $\hat{V}$ denotes the residuals obtained by estimating equation (3.3) excluding Y_1 on the right-hand side. This is a potentially valid instrument because $[X - \mathrm{E}(X)]\hat{V}$ is exogeneous in (3.2) as it is already assumed that $\mathrm{Cov}(X, UV) = 0$ and it is correlated with Y_2 through V. It is worth noting here that the condition $\mathrm{Cov}(X, V^2) \neq 0$ need to hold only for a subset Z of the vector X.

3.7.2 Alternative measure of local financial development

Table B.1: The effects on growth rate of sales per worker

	heteroscedasticity-based identification				
	Endogeneity			Endogeneity and non-linearity	
	FD	IC	FD and IC	FD	IC
	(1)	(2)	(3)	(4)	(5)
FD2	0.362***	0.142***	0.142***	0.222***	0.107***
	(0.020)	(0.013)	(0.013)	(0.011)	(0.008)
Informal charges (IC)	−0.079***	−0.068***	−0.068***	−0.082***	−0.072***
	(0.010)	(0.017)	(0.017)	(0.004)	(0.008)
FD2*IC	−0.187***	−0.063***	−0.063***	−0.148***	−0.140***
	(0.018)	(0.015)	(0.015)	(0.010)	(0.018)
Initial	−1.039***	−1.040***	−1.040***	−1.039***	−1.039***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Labour	0.060***	0.058***	0.058***	0.059***	0.059***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Asset	0.002	0.004***	0.004***	0.003***	0.004***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private	−0.036*	−0.057***	−0.057***	−0.046***	−0.045***
	(0.022)	(0.021)	(0.021)	(0.010)	(0.015)
Provincial per capita income	0.002***	0.003***	0.003***	0.003***	0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year2010	0.045***	0.096***	0.096***	0.076***	0.099***
	(0.012)	(0.014)	(0.014)	(0.008)	(0.011)
Year2011	−0.072***	−0.034	−0.034	−0.058***	−0.021*
	(0.013)	(0.022)	(0.022)	(0.010)	(0.011)
Year2012	−0.099***	−0.030*	−0.030*	−0.065***	−0.029**
	(0.015)	(0.018)	(0.018)	(0.013)	(0.012)
FD22				−0.009	
				(0.010)	
IC2					−0.042***
					(0.006)
Constant	−0.009***	−0.001	−0.001	−0.006***	0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	135321	135321	135321	135321	135321
R-squared	0.577	0.578	0.578	0.578	0.578
Overidentification	0.147	0.064	0.064	0.239	0.318
Weak identification	87.312	87.363	87.363	413.110	106.836
Differentials in growth rates					
IC at 25th, FD increases	−0.649	−0.184	−0.184	−0.467	−0.773
IC at 75th, FD increases	−1.052	−0.319	−0.319	−0.785	−1.075
Difference	0.403	0.136	0.136	0.319	0.301

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variable is annual growth rate of sales per worker and measured from 2010 to 2013. 'FD increases' in the bottom panel refer to the change of level of province-level financial development ('FD2') from the 25th to the 75th percentile. For further notes see Table 3.3.

Table B.2: The effects on growth rate of sales

	heteroscedasticity-based identification				
	Endogeneity			Endogeneity and non-linearity	
	FD	IC	FD and IC	FD	IC
	(1)	(2)	(3)	(4)	(5)
FD2	0.165***	0.035**	0.035**	0.092***	0.004
	(0.024)	(0.016)	(0.016)	(0.010)	(0.008)
Informal charges (IC)	−0.053***	−0.038**	−0.038**	−0.051***	−0.039***
	(0.009)	(0.015)	(0.015)	(0.004)	(0.006)
FD2*IC	−0.129***	−0.036*	−0.036*	−0.112***	−0.015
	(0.024)	(0.019)	(0.019)	(0.016)	(0.026)
Initial	−0.978***	−0.978***	−0.978***	−0.978***	−0.975***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)
Labour	0.118***	0.117***	0.117***	0.117***	0.115***
	(0.003)	(0.002)	(0.002)	(0.001)	(0.002)
Asset	−0.001	0.002***	0.002***	0.001	0.002***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Private	0.005	−0.001	−0.001	0.003	−0.020
	(0.020)	(0.015)	(0.015)	(0.015)	(0.015)
Provincial per capita income	−0.002***	−0.001*	−0.001*	−0.001***	−0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)
Year2010	0.136***	0.168***	0.168***	0.159***	0.171***
	(0.014)	(0.015)	(0.015)	(0.007)	(0.008)
Year2011	0.040***	0.069***	0.069***	0.054***	0.067***
	(0.011)	(0.017)	(0.017)	(0.008)	(0.009)
Year2012	−0.021*	0.028**	0.028**	0.003	0.030***
	(0.013)	(0.013)	(0.013)	(0.010)	(0.009)
FD22				−0.012	
				(0.011)	
IC2					−0.001
					(0.006)
Constant	−0.003*	0.003*	0.003*	−0.002	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	135368	135368	135368	135368	135368
R-squared	0.543	0.543	0.543	0.543	0.543
Overidentification	0.117	0.227	0.227	0.242	0.367
Weak identification	110.951	79.596	79.596	552.701	98.353
Differentials in growth rates					
IC at 25th, FD increases	−0.596	−0.186	−0.186	−0.394	−0.096
IC at 75th, FD increases	−0.874	−0.263	−0.263	−0.635	−0.128
Difference	0.278	0.077	0.077	0.241	0.032

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variable is annual growth rate of sales and measured from 2010 to 2013. 'FD increases' in the bottom panel refer to the change of level of province-level financial development ('FD2') from the 25th to the 75th percentile. For further notes see Table 3.4.

Table B.3: The effects on growth rate of investment

	heteroscedasticity-based identification				
	Endogeneity			Endogeneity and non-linearity	
	FD	IC	FD and IC	FD	IC
	(1)	(2)	(3)	(4)	(5)
FD2	0.163***	0.028*	0.028*	0.080***	0.011
	(0.022)	(0.016)	(0.016)	(0.011)	(0.009)
Informal charges (IC)	−0.043***	−0.032**	−0.032**	−0.050***	−0.037***
	(0.008)	(0.012)	(0.012)	(0.005)	(0.005)
FD2*IC	−0.150***	−0.082***	−0.082***	−0.137***	−0.073***
	(0.022)	(0.019)	(0.019)	(0.019)	(0.028)
Initial	−0.986***	−0.985***	−0.985***	−0.985***	−0.982***
	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Labour	0.137***	0.136***	0.136***	0.136***	0.132***
	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)
Asset	−0.000	0.003**	0.003**	0.001*	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Private	0.037*	0.031*	0.031*	0.049***	0.028**
	(0.020)	(0.018)	(0.018)	(0.014)	(0.013)
Provincial per capita income	−0.000	0.000	0.000	−0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year2010	0.071***	0.110***	0.110***	0.087***	0.100***
	(0.011)	(0.017)	(0.017)	(0.008)	(0.009)
Year2011	0.049***	0.083***	0.083***	0.057***	0.074***
	(0.010)	(0.017)	(0.017)	(0.008)	(0.009)
Year2012	0.131***	0.184***	0.184***	0.155***	0.176***
	(0.013)	(0.016)	(0.016)	(0.012)	(0.010)
FD22				−0.037***	
				(0.011)	
IC2					−0.006
					(0.006)
Constant	−0.009***	−0.004***	−0.004***	−0.006***	−0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Observations	132108	132108	132108	132108	132108
R-squared	0.523	0.524	0.524	0.524	0.524
Overidentification	0.093	0.130	0.130	0.151	0.256
Weak identification	108.446	80.221	80.221	493.703	105.763
Differentials in growth rates					
IC at 25th, FD increases	−0.744	−0.514	−0.514	−0.141	−0.482
IC at 75th, FD increases	−1.067	−0.690	−0.690	−0.436	−0.639
Difference	0.323	0.177	0.177	0.295	0.157

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variable is annual growth rate of investment and measured from 2010 to 2013. 'FD increases' in the bottom panel refer to the change of level of province-level financial development ('FD2') from the 25th to the 75th percentile. For further notes see Table 3.5.

4 Does local financial development matter for the gender gap in promoting firm growth in Vietnam?

Viet Tuan Tran

Abstract. Whether local financial development could reduce the constraints for women to promote economic growth is an important question that has received little attention. In this paper, we use data of more than 40,000 firms collected in Vietnam from 2009 to 2013 to examine the effects of local financial development, male ownership and the joint effects of these factors on firm growth. To address endogeneity issues which might arise by the causality from firm growth to local financial development, we employ a heteroscedasticity-based identification strategy. The results show that local financial development promotes firm growth in terms of the growth rates of sales, investment, return on assets (ROA), and return on equity (ROE). The results also document that male-owned firms perform better than female-owned firms in terms of the growth rates of sales, investment, ROA, and ROE. Moreover, the joint effect of local financial development and male ownership is significantly negative through all specifications. This implies that local financial development could help reduce the gender gap in promoting firm growth.

4.1 Introduction

As one of the most debated and still growing literature in economics, the relationship between financial development and economic growth has been studied at both macro and micro levels. Most studies show that financial development facilitates economic growth (e.g., King and Levine, 1993; Rajan and Zingales, 1998; Levine et al., 2000). On the contrary, a sizable number of studies document that the causality from financial development to economic growth is weak and fragile (Andersen and Tarp, 2003), or the resultant financial development stems from economic growth (Ang and McKibbin, 2007). In addition, Arcand et al. (2015) find that if the ratio of credit to private sector over the Gross Domestic Products (GDP) reaches a certain high level (80% of

GDP), the effect of financial development on economic growth becomes negative. This finding implies that 'too much finance' may hinder economic growth. Accounting for other potential determinants, a number of studies show that the finance-growth nexus depends on various factors such as institutional quality, level of economic development, trade openness and financial globalization (e.g., Ahlin and Pang, 2008; Law et al., 2013; Herwartz and Walle, 2014a).

One important dimension in the finance-growth debate, which has received less attention so far at both the macro and micro levels, is the gender difference in taking advantage of financial development. In particular, existing studies often show that lack of access to finance hinders entrepreneurship and impedes women from participating in the market economy. A cross-country study by Muravyev et al. (2009) documents that female-managed firms are less likely to get credit from formal financial suppliers or have to pay a higher interest rate than their male-managed counterparts. Moreover, Richardson et al. (2004) show that female-owned enterprises in Sub-Saharan Africa tend to rely more on internal and informal financing than male entrepreneurs. This implies higher financial constraints for women in accessing credit, especially in developing countries. As documented in extensive and growing literature, finance plays an important role in promoting firm growth, especially for small firms (Beck et al., 2005; Fafchamps and Schündeln, 2013), and enhancing entry and performance of new firms (Guiso et al., 2004; Klapper and Parker, 2010; Rajan and Zingales, 1998). However, to the best of our knowledge, there is no study investigating whether local financial development matters for the gender gap in promoting firm growth.

In this study, we analyse gender differences in exploiting the benefit of province-level financial development to promote firm growth in Vietnam. Specifically, we use firm-level panel data from Vietnamese Enterprise Survey (VES), which is a representative survey conducted by the Vietnam General Statistics Office (VGSO) and covers more than 40,000 firms spanning from 2009 to 2013. We first investigate the effect of local financial development and male ownership on firm growth. Furthermore, we examine whether female-owned firms could exploit the advance of local financial development to reduce their constraints compared with male-owned firms in fostering firm growth.

To measure firm growth, we consider two aspects including firm performance, which is based on the growth rates of investment and sales, and firm productivity using the growth rates of return on assets (ROA) and returns on equity (ROE). In addition, we measure province-level financial development using the number of financial suppliers per 1000 people in each province and consider the number of financial suppliers per square kilometer in each province as a robustness check.

Vietnam represents an appropriate case for study for four main reasons. First, as an emerging economy, Vietnam has shown rapid growth rates in both the economic and financial sectors. Keeping the growth rate of GDP at more than 6 percent over the past three decades, Vietnam has transformed itself from one of the poorest economies into a lower middle-income economy despite the uncertainties of the global economy (World Bank, 2016). Similarly, the financial sector has exhibited steady growth since implementing the renovation policy, which was launched in the 1980s. For a lower middle-income country, the Vietnamese financial sector is considered to be large with the share of total assets at the end of 2011 constituting about 200 percent of GDP (World Bank, 2014). However, despite this fact, a number of small and medium-sized enterprises (SMEs) are constrained by external finance, and access to finance is one of the most difficult obstacles for firms (World Bank, 2014). Second, as reported by the World Bank (2016), although gender inequality has been decreased in Vietnam, social discrimination in gender is still present in society and in the economy. Therefore, the issue of financial constraints with respect to gender still needs to be examined in the Vietnamese context. Moreover, while extant studies on Vietnamese firms examine the relationship between finance and growth (e.g., O'Toole and Newman, 2017; Anwar and Nguyen, 2011; Rand and Tarp, 2012; Nguyen and Van Dijk, 2012), none of them has considered the joint impacts of local financial development and entrepreneurs' gender on firm growth. Finally, our study is closely related to the recent study by Pham and Talavera (2018), which does not find the evidence of discrimination between males and females by Vietnamese financial suppliers and this finding is different from previous studies (e.g., Blanchflower et al., 2003; Cavalluzzo and Cavalluzzo, 1998; Madill et al., 2006). While previous studies on Vietnam focus separately on the effect of finance or gender on economic growth, our

study provides further empirical evidence on the relationship between local financial development, entrepreneurs' gender and firm growth and additionally, examines the joint effects of local financial development and entrepreneurs' gender on firm growth in Vietnam.

Employing the recently suggested methodology of identification through heteroscedasticity (Lewbel, 2012), our results are consistent with the use of different local financial development indicators and the use of external instruments complementing the use of heteroscedasticity-based instruments. Our results show that province-level financial development has a positive impact on firm growth. In particular, province-level financial development fosters the growth rates of investment, sales, ROA and ROE. Moreover, while male-owned firms have more advantage in promoting firm growth, controlling for the interaction between local financial development and male ownership, the results document that female-owned firms are less constrained in enhancing firm growth by exploiting the local financial development.

In Section 4.2, we briefly review the extant literature on the relationship between financial development and growth, entrepreneurs' gender and firm growth. We provide the descriptive statistics of the data in Section 4.3. The methodology and model specifications are provided in Section 4.4. In Section 4.5, we discuss the main results and provide the robustness check by using an alternative measure of local financial development. Section 4.6 concludes the main findings and provides policy implications.

4.2 Literature and hypotheses

In this section, we first provide a brief review of the literature on the relationship between finance and growth at distinct levels: country-level financial development and economic growth, within country heterogeneity on financial development and local economic development. Next, we discuss the literature on the gender gap in access to finance and in effects on firm performance. We conclude this section by introducing some studies related to Vietnam and discuss the gap in the literature.

4.2.1 The finance-growth nexus

A large number of studies have been carried out at both the micro and macro level on the relationship between financial development and economic growth. At the macro level, one of the earliest works is Goldsmith (1969), which documents a positive correlation between finance and economic growth but does not show in which direction the effect appears. Using data from countries after the Second World War, McKinnon (1973) finds that faster economic growth is caused by better financial systems. Similarly, King and Levine (1993) show a strong impact of finance on economic growth based on data covering 80 countries from 1960 to 1989. However, there might be concerns about the endogeneity issue which may stem from the fact that economic growth causes financial development and not vice versa (Robinson, 1952). Accounting for this issue, Levine et al. (2000) and Levine (2005) use a wide range of instrumental variables and examine the effect of financial development on economic growth using cross-country data from 1960 to 1995. Their results show that financial development fosters economic growth.

Although most of the above-mentioned studies document an important role of financial development in promoting economic development, there are still a number of existing studies that provide different or opposite conclusions. Lucas (1988) and Andersen and Tarp (2003) doubt the existence of a meaningful relationship between financial development and economic growth. In addition, Robinson (1952) and Ang and McKibbin (2007) even conclude that economic growth causes the development of finance and not vice versa. Recently, Herwartz and Walle (2014a) report that the finance-growth nexus could depend on the level of economic, institutional and financial development. Moreover, Arcand et al. (2015) show that the effect of financial development on economic growth depends on the level of financial development. Specifically, at an intermediate level, financial development fosters economic growth; however, the effect becomes negative if the level of financial development reaches a certain high level (e.g., the ratio of credit to the private sector reaches 80 to 100% of GDP).

There are also studies investigating the impact of country-level financial development on the level of economic development at the micro level including regional, sector, industry, firm and household levels. Using firm-level data covering 30 countries,

Demirgüç-Kunt and Maksimovic (1996) show that the development of stock markets and legal systems increases the growth rate of firms and the possibility for firms to get external finance. Beck et al. (2000) document that financial-activity, which measures financial development as a combination of bank indicators (private credit) and stock market operation (total shares' traded value), enhances long-term growth rates of firms with demand for credit and industries with relatively high dependence on external finance. Moreover, accounting for the financial, legal and corruption constraints on the growth of firms, Beck et al. (2005) report that financial development reduces the constraints on firms differently depending on their size. In particular, the smallest firms benefit the most from financial development. Adeniyi et al. (2015) re-examine the relationship between financial development and economic growth in Nigeria from 1960 to 2010 and find that the effect of finance on growth has some turning points. In particular, financial development has a negative impact on growth, but it changes the effect at a threshold level.

Accounting for the effect of external financial dependence in each sector, which could affect the finance-growth nexus, Rajan and Zingales (1998) report that in economies with better financial development, industries relying on external finance grow faster than industries that do not rely on external finance. Revisiting the study of Rajan and Zingales (1998), Fisman and Love (2007) argue that financial suppliers might finance the sectors with better growth opportunities and therefore, instead of using external financial dependence in each sector, they suggest the use of growth opportunities in each sector to address this concern. Using the same data as in Rajan and Zingales (1998), they report that in countries with higher financial development, sectors with better growth opportunities grow faster than sectors with lower growth opportunities. Moreover, accounting for the external financial dependence indicator, they suggest that the effect of growth opportunities encompasses the effect of external finance dependence.

Compared with the cross-country and country levels, less attention has been paid to the within country heterogeneity in financial development and its effect on economic growth. To name a few, Jayaratne and Strahan (1996) show that the reform in the banking branch at the intrastate level, which is associated with the change in bank

lending quality, has a positive effect on per capita growth in the US. Examining the relationship between regional financial development and performance of firms in Italy, Guiso et al. (2004) find that regional financial development enhances firm performance in terms of increasing firm growth rates, promoting competition and favoring the entry of new firms. Based on a panel data on Vietnamese provinces spanning from 1997 to 2006, Anwar and Nguyen (2011) find evidence that provincial financial development, which is measured as the ratio of credit to private sector over gross provincial products, fosters economic growth at the province level. Exploiting an extensive firm-level survey in Vietnam, O'Toole and Newman (2017) show that province-level financial development mitigates the external financing constraints faced by firms and promotes investment activity. Studying at a more aggregated level of financial development, Kendall (2012) finds that district-level financial development, which is measured by the ratio of bank credit to net domestic product in districts in India, has a positive impact on district-level economic growth. Further extending the research of Fisman and Love (2007), Fafchamps and Schündeln (2013) document that the availability of bank branches at the commune level in Morocco promotes the growth rates of small and medium-sized firms that operate in sectors with growth opportunities. Employing the method of identification through heteroscedasticity, Tran et al. (2018) find that local financial development, which is measured at three distinct levels (district, sub-district and village), has a positive impact on Vietnamese household welfare including consumption, income, and consumption smoothing.

4.2.2 Gender, credit access and economic growth

The gender gap in access to finance is one of the increasing concerns to policy makers, especially in developing countries. It is often argued that women have less advantage than men in access to finance, therefore impeding them from entrepreneurship. However, still many studies show different conclusions. For instance, on the one hand, based on a cross-country study, Muravyev et al. (2009) find that women have more constraints in accessing finance from formal financial suppliers and have to pay higher interest rate than men. Focusing on Sub-Saharan Africa, Richardson et al. (2004) show that

female-owned enterprises are more likely to rely on internal or informal credit than male-owned enterprises. On the other hand, Bruhn (2009) does not find a gender gap in access to credit by enterprises in Latin America. Additionally, Aterido et al. (2011) study on Sub-Saharan Africa and across the world and show evidence that firms owned by females do not have worse access to credit than firms owned by males. Brown et al. (2011) suggest that such controversial findings may depend on country-specific factors such as institutional and market elements, which influence the credit demand and credit rationing of firms.

A number of studies have explored the reasons behind the gender gap in access to finance. While Buvinic and Berger (1990) argue that female-owned firms struggle more with credit applications than male-owned firms, Lusardi and Tufano (2009) document the lack of financial literacy among females. Moreover, Beck et al. (2011) find that the difference in behaviour might be important and leads to a taste-based rather than a statistical bias. Similarly, Cavalluzzo et al. (2002) find that observed gender gaps might be the result of discrimination from the supply-side; for instance, financial suppliers could treat applications from male and female-owned enterprises differently. On the other hand, Drakos and Giannakopoulos (2011) document that gender gaps in credit access may stem from the demand-side that could affect actual loan application preparation. While showing the lack of difference in access to finance in Sub-Saharan Africa and the world, Aterido et al. (2011) propose the reasons which might come from the fact that female-owned firms have less proprietorship, more regulatory burden, smaller size, and operated in sectors that are less reliant on external finance. Moreover, some studies also argue that the reasons may come from a different measurement of credit constraints (Hansen and Rand, 2014) and the definition of gender structure in firms (Presbitero et al., 2014). Results from empirical studies on the gender gap in access to finance, therefore, are not consistent and generalizable.

The relationship between financial development, entrepreneurs' gender and economic development has been paid very little attention to within empirical studies for Vietnam. To the best of our knowledge, there is no study on the gender gap in taking advantage of financial development to promote firm growth in Vietnam. To name a few related

studies on this issue, Greig et al. (2006) implement a survey of about 500 larger and formal women business owners in Vietnam. They find that while women business owners confirm the sufficient level of capital for their demand, most of them indicate the shortage of financial management skills. This survey also suggests that national policymakers should set up special loan funds or guarantee schemes for small, women-owned enterprises. Exploring the impact of governmental policies and socio-cultural factors on female entrepreneurship in rural Vietnam, Nguyen et al. (2014) conclude that women are constrained by financial limitations, educational opportunities, and societal prejudices. Pham and Talavera (2018) examine the relationship among gender, social capital, and access to finance of manufacturing firms in Vietnam. They do not find evidence of discrimination in the formal lending market against female-owned firms. In particular, female-owned firms have a higher possibility of access to finance and paying lower interest rates than male-owned firms. Moreover, firms would benefit from a relationship with government officials in terms of increasing the duration of loans. However, these studies still do not account for the difference between firms owned by males and females in exploiting the development of the financial sector at the local level. Specifically, there appears to be a lack of evidence in empirical studies on whether local financial development could help reduce women's constraints in promoting firm growth.

4.3 Data

In this section, we briefly provide the discussion on data collection and then deliver summary statistics for variables including the indicators to measure firm growth and province-level financial development used in this study. We also summarize firm-and province-level characteristics.

Data collection

The data sets used in this study originate from two different sources: Vietnamese firm-level and province-level data. The firm-level data is annually surveyed by the VGSO and includes more than 40,000 firms in the periods spanning from 2009 to 2013. The data is collected from the survey on Vietnamese firms, which were selected based on the number of employees. It included the population of firms with more than thirty

employees and a representative sample of firms, which had less than thirty employees. The data is collected annually in all 63 provinces and covers all sectors or industries of the Vietnamese economy. The questionnaire was mailed out to firms and required to fill by the finance manager or the equivalent of the firms depending on the size under the Law on Statistics. The questionnaire captures all related information on firms' balance sheets and other firm characteristics. The province-level data is the combination of aggregated data from the firm-level survey and provincial data from the VGSO. In Table 4.1, we briefly provide the characteristics of firms and provinces in this study. Panels A and B of Table 4.1 document firm-level and province-level characteristics, respectively.

Measuring firm growth

To measure firm growth, this study uses the annual nominal growth rates of investment, sales, returns on assets (ROA), and returns on equity (ROE) from 2010 to 2013. These indicators characterize the output and productivity of firm performance and are treated as dependent variables in this study. In the dataset, investment is measured by the annual costs for manufacturing firms and sales are based on the total revenue the firm received from providing all products and services. On average, the growth rates of investment and sales are 20.2% and 17.4%, respectively. ROA and ROE indicators are, respectively, measured by dividing total net income of the firm by the firm's asset and equity. These indicators are expected to show the effectiveness of the firm's management of asset and equity. The average annual growth rates of ROA and ROE are 12.8% and -5.8%, respectively.

Explanatory variables

To minimize the possibility of endogeneity, this study uses explanatory variables from 2009 to 2012, which are lagged one period compared with the dependent variables. As can be seen from panel A of Table 4.1, a firm invests an average of 6.6 billion Vietnamese Dong (VND) for operations and gains about 7.5 billion VND from sales, on average.[17] The average of ROA and ROE are 124.8% and 303.2%, respectively. Each firm also has about eight employees and possesses assets worth of more than 10.5 billion VND,

[17]In 2009, one US dollar equaled to 17,065 Vietnamese Dong (World Bank, 2009). The average inflation rate during the period 2009-2013 was about 8.4% according to the VGSO.

on average. The rate of purely private ownership is more than 33.8%, which indicates that 66.2% of firms are fully or partially owned by foreigners or the government. The education index measures the education level of the firm owners, which ranges from one to eight, where the higher number represents a higher level of education. The average education level is about four, showing that most of the owners obtaining a vocational certificate. Firm age is measured by using the number of years that a firm has operated up to the current year. On average, firm age is about 4.4 years and ranges from 0 to 24, which shows that most of the firms in Vietnam are new establishments.[18] In addition, there is about 71.8% of firms that are owned by males. More details of firm characteristics by gender are provided in Table 4.2.

Measuring local financial development

Panel B of Table 4.1 provides information about province-level characteristics. On average, per capita income at the province level is about 29 million VND, which is in accordance with the fact that Vietnam is a lower-middle income economy. The population density by province is about 567 people per square kilometre. Moreover, local financial development is measured by using the number of credit suppliers per capita (FD1) and per square kilometre (FD2). On average, there are more than two financial suppliers per 100,000 people and per 100 square kilometres. The first indicator (FD1) of financial development will be used as our baseline indicator, representing the province-level financial development. The second indicator (FD2) is used as a robustness check. The two indicators have a correlation of more than 0.81.

[18]We exclude the outliers of firm age at less than 0.05 percentile of the firm age distribution.

Table 4.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: Firm-level characteristics					
Investment annual growth	137926	0.202	1.501	-11.777	12.848
Sales annual growth	141022	0.174	1.427	-10.303	12.968
ROA annual growth	140935	0.123	1.829	-11.199	15.409
ROE annual growth	137284	0.128	1.815	-10.948	14.357
Investment$^{(a)}$	136705	6.618	23.008	0	802.035
Sales$^{(a)}$	134887	7.516	25.290	0	870.854
ROA	132780	1.248	3.105	0	99.321
ROE	128953	3.032	6.748	0	99.520
Labour	136861	8.148	7.106	1	335.000
Asset$^{(a)}$	136861	10.577	39.560	0	3714.134
Private ownership	151336	0.338	0.473	0	1
Education	151335	4.041	1.882	1	8
Firm age	151336	4.378	3.459	0	24
Male	151335	0.718	0.450	0	1
Panel B: Provincial characteristics					
Provincial per capita income (GDPP)$^{(b)}$	164	29.292	38.616	9.329	327.194
Population density (1000 per km2)	164	0.567	0.624	0.082	3.656
Number of credit suppliers per 1000 capita (FD1)	162	0.025	0.025	0.001	0.127
Number of credit suppliers per km^2 (FD2)	162	0.025	0.061	0.000	0.429

Notes: All growth rates are computed as differences in natural logarithms of annual sales, investment, ROA and ROE for the years 2010 to 2013. The remaining firm level and province level characteristics are lagged values, i.e., measured from 2009 to 2012. The superscripts $^{(a)}$ and $^{(b)}$ indicate that the variable is measured in billion and million VND, respectively.

Table 4.2: Firm level characteristics by gender

	Male ownership			Female ownership		
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.
Investment annual growth	98916	0.201	1.511	38958	0.205	1.474
Sales annual growth	101005	0.174	1.441	39965	0.175	1.390
ROA annual growth	100942	0.119	1.831	39941	0.135	1.824
ROE annual growth	98518	0.126	1.817	38714	0.133	1.808
Investment	98177	6.241	21.304	38528	7.579	26.843
Sales	96845	7.114	23.631	38042	8.540	29.064
ROA	95238	1.185	2.968	37490	1.408	3.423
ROE	92697	2.875	6.466	36204	3.437	7.409
Labour	98245	8.297	7.237	38557	7.770	6.751
Asset	98245	10.317	38.093	38557	11.247	43.093
Private ownership	108548	0.339	0.474	42727	0.335	0.472
Education	108548	3.990	1.837	42727	4.171	1.987
Firm age	108548	4.283	3.358	42727	4.622	3.695

Notes: All growth rates are computed as differences in natural logarithms of annual sales, investment, ROA and ROE for the years 2010 to 2013. The remaining firm-level characteristics are lagged values, i.e., measured from 2009 to 2012.

4.4 Model specification

Studies on the finance-growth nexus at both the macro and the micro level might suffer from the potential reverse causality as economic development may cause financial

development (e.g. Ang and McKibbin, 2007). Therefore, the problem of endogeneity in the finance-growth nexus has been considered as a serious challenge. Obviously, the problem of endogeneity is less serious at the micro level research since individual firm growth is less likely to affect the development of the financial sector at a local level such as the regional and provincial level. In order to address the endogeneity issue, the use of standard instruments is widely suggested even though the appropriate instruments are very difficult to find in practice due to strict conditions. Alternatively, Arellano and Bond (1991) and Blundell and Bond (1998) proposed the use of Generalized Method of Moments (GMM) for dynamic panel data, however, these methods are not suitable to the nature of our data with limited time span.

To deal with endogeneity problems in estimating the model, we apply the heteroscedasticity-based identification strategy (Lewbel, 2012), which is built based on a previous work by Rigobon (2003). Lewbel (2012) suggests the use of internal instruments, which are generated by exploiting the correlation between heteroscedastic disturbance of the model and exogenous variables, without imposing any exclusion restriction.

We briefly provide the description of the heteroscedasticity-based identification strategy by starting the simultaneous model as follows:

$$Y_1 = X\alpha_1 + Y_2\alpha_2 + \epsilon \tag{4.1}$$

$$Y_2 = X\beta_1 + Y_1\beta_2 + \sigma \tag{4.2}$$

where Y_1 is the response variable (for example, firm growth indicators), vector X includes the set of exogenous explanatory variables, Y_2 is the endogenous variable (e.g., local financial development indicator), ϵ and σ are the error terms of each model.

As standard assumption, the structural error terms in model (4.1) and (4.2) are assumed to be independent from each other and from the explanatory variables X. Lewbel (2012) additionally assumes the model suffer from heteroscedasticity in σ (and hence Y_2). Therefore, we have the standard conditions

$$Cov(X, \epsilon) = Cov(X, \sigma) = Cov(X, \epsilon\sigma) = 0 \tag{4.3}$$

and the heteroscedasticity in σ

$$Cov(X, \sigma^2) \neq 0 \tag{4.4}$$

To get the instrumental variable estimation of (4.1), Lewbel (2012) suggests to instrument Y_2 by using $[X - E(X)]\hat{\sigma}$, where $\hat{\sigma}$ denotes the predicted residual obtained from estimating the model (4.2) excluding Y_1 on the right-hand side. This is a potential valid instrument because $[X - E(X)]\hat{\sigma}$ is exogenous in (4.1) as it is already assumed that $Cov(X, \epsilon\sigma) = 0$ and it is correlated with Y_2 through σ as in (4.2).

Applying the above strategy to identify the effects of local financial development, male ownership and their interaction on firm performance, we estimate the following model:

$$\begin{aligned} \Delta Y_{fit} = \alpha_0 + \alpha_1 FD_{i,t-1} + \alpha_2 Male_{fi,t-1} + \alpha_3 FD_{i,t-1} * Male_{fi,t-1} + \\ + \alpha_4 Y_{fi,t-1} + X_{fi,t-1}\boldsymbol{\beta} + \epsilon_{fit}, \end{aligned} \tag{4.5}$$

$$\Delta Y_{fit} = ln(Y_{fit}) - ln(Y_{fi,t-1}) \tag{4.6}$$

where Y_{fit} represents firm performance including investment, sales, ROA and ROE of firm f at province i in year t. ΔY_{fit}, which is calculated as in equation (4.6), represents a measure of performance (e.g., annual growth rates of investment, sales, ROA and ROE) of firm f at province i from year $t-1$ to year t. $FD_{i,t-1}$ indicates province-level financial development at province i in time $t-1$. $Male_{fi,t-1}$ denotes the male ownership of the firm f at province i in time $t-1$. The lagged dependent variable (in level) $Y_{fi,t-1}$ is included to control for the effects of initial conditions. The vector $X_{fi,t-1}$ stacks all other firm and local characteristics at time $t-1$ and ϵ_{fit} is the error term.

Following the procedure suggested by Baum and Schaffer (2012) for panel data, we use within transformation on our panel data to eliminate firm-specific fixed effects and applying the method suggested by Lewbel (2012) on the transformed data. Moreover, Lewbel (2012) suggest the use of external instruments to augment heteroscedasticity-based instruments to improve the efficiency of estimation. In particular, while our main identification strategy is based on the heteroscedasticity-based instruments, we also use

population density at the province level as a standard instrument for province-level financial development to complement heteroscedasticity-based instruments.

The model as in (4.5) is expected to show the effects of local financial development, male ownership on firm performance and especially find the difference between firms owned by males and females in exploiting the advantage of financial development at the local level. In accordance with literature and previous studies, we expect that local financial development fosters firm growth (α_1 is expected to be positive), firms owned by males would have more advantage than firms owned by females in enhancing firm growth (α_2 is expected to be positive). However, local financial development would help female-owned firms reduce their constraints in promoting firm growth (α_3 is expected to be negative).

4.5 Empirical results

In this section, we provide the empirical results on the effects of province-level financial development, male ownership and the joint effects of these indicators on firm growth. We first examine the effects on firm growth including the growth rates of investment and sales and then further investigate the effects on firm productivity or performance in terms of the growth rates of ROA and ROE. Finally, we provide some robustness check results using an alternative measure of province-level financial development to show the consistency of our main findings.

4.5.1 The effects on the growth rates of investment and sales

Table 4.3 shows the results of examining the effects of local financial development, male ownership, joint effects of local financial development and male ownership, and other determinants on the growth rates of investment and sales. Employing the heteroscedasticity-based identification, for each dependent variable, the results are reported using heteroscedasticity-based instrument (hetero IV) and the augmented heteroscedasticity-based instrument with external instruments (all IV). The model diagnostics include the tests of underidentification, overidentification and weak identification, which are provided in the last three rows of the table. The

underidentification is based on Kleibergen and Paap (2006), which is an LM test with the null hypothesis that the model is underidentified. The overidentification test is the Hansen J test, which examines the null hypothesis that all instruments are invalid. The reported statistics of underidentification and overidentification tests are p-values. Finally, weak identification test is a Wald F test based on Kleibergen-Paap rk statistics with the null hypothesis is that the instruments are weak or have low correlation with the corresponding variables. As can be seen from the bottom rows of Table 4.3, the model diagnostics support our estimation strategy.

With respect to the growth rate of investment, the results are provided in the first four columns of Table 4.3. Specifications 1 and 2 provide the results obtained without accounting for year dummies, which might be associated with any aggregate shock to nominal investment growth such as inflation and policy, while specifications 3 and 4 account for this effect by using a full set of calendar year dummies from 2009 to 2012. We use 2009 as the based year, and therefore it is omitted from our tables. While specifications 1 and 3 use only heteroscedasticity-based instruments (hetero IV), the specifications 2 and 4 complement heteroscedasticity-based instruments with external instruments (all IV). Additionally, we use population density at the province level as a standard instrument for the local financial development. This instrument has been previously suggested in Kendall (2012) based on the fact that it might be easier to find a credit supplier in more densely populated areas. Similar to previous studies on the effects of local financial development on economic growth (e.g., Fafchamps and Schündeln, 2013; Tran et al., 2018), our results show that province-level financial development fosters firm growth in terms of the growth rate of investment. As shown in the first column, a 1% increase in province-level financial development would lead to a 0.135% increase in the growth rates of investment. The effect does not change much (0.118%) if we use the external instrument complementing the heteroscedasticity-based instrument, which is shown in specification 2. Although the effect of province-level financial development on the growth rate of investment is still significantly positive, the magnitude is lower when accounting for the effect of factors that change from year to year, especially price indices. In particular, the effect of local financial development decreases to 0.082% and 0.034%

Table 4.3: The growth rates of investment and sales

	Investment				Sales			
	Hetero IV	all IV	hetero IV	all IV	hetero IV	all IV	hetero IV	all IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD1	0.135***	0.118***	0.082***	0.034*	0.441***	0.389***	0.084**	0.056**
	(0.011)	(0.010)	(0.025)	(0.020)	(0.012)	(0.007)	(0.034)	(0.024)
Male	0.028***	0.025***	0.031***	0.028***	0.008	0.004	0.016***	0.007
	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
FD1*Male	−0.125**	−0.110***	−0.142***	−0.120***	−0.078**	−0.055***	−0.089***	−0.075***
	(0.050)	(0.027)	(0.024)	(0.019)	(0.036)	(0.015)	(0.021)	(0.016)
Initial	−0.971***	−0.970***	−0.968***	−0.969***	−0.953***	−0.953***	−0.957***	−0.957***
	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Labour	0.129***	0.129***	0.137***	0.138***	0.117***	0.117***	0.112***	0.116***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Asset	0.008***	0.008***	0.000	−0.000	−0.009***	−0.008***	0.002	0.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Private ownership	0.011	0.015	0.004	0.007	−0.019	−0.013	−0.035**	−0.019
	(0.016)	(0.015)	(0.015)	(0.014)	(0.018)	(0.013)	(0.015)	(0.013)
GDPP	−0.001	−0.001	0.000	0.001***	−0.005**	−0.005***	−0.001**	0.000**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)
Education	−0.003***	−0.003***	−0.004***	−0.004***	−0.002**	−0.002**	−0.004***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm age	0.048***	0.051***	0.047***	0.044***	−0.008	−0.001	0.021**	0.008**
	(0.014)	(0.013)	(0.009)	(0.004)	(0.023)	(0.016)	(0.009)	(0.004)
Year2010			−0.009**	−0.012***			0.010	0.013**
			(0.004)	(0.003)			(0.007)	(0.006)
Year2011			0.033***	0.042***			0.159***	0.169***
			(0.006)	(0.005)			(0.007)	(0.005)
Year2012			−0.031***	−0.031***			0.063***	0.061***
			(0.003)	(0.003)			(0.003)	(0.003)
Constant	0.000***	0.000***	0.001	−0.001	0.003***	0.003***	−0.056***	−0.059***
	(0.000)	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)	(0.003)	(0.003)
Observations	137782	137782	137782	137782	140874	140874	140874	140874
R-squared	0.550	0.550	0.550	0.551	0.571	0.571	0.573	0.573
Underidentification	0.025	0.033	0.069	0.112	0.059	0.023	0.070	0.114
Overidenfication	0.197	0.252	0.412	0.360	0.119	0.220	0.368	0.114
Weak identification	300.044	759.698	239.507	352.181	359.561	1143.550	257.441	362.473

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variables are annual growth rates of sales and investment, which are measured from 2010 to 2013. All explanatory variables are measured from 2009 to 2012. 'FD12' denotes the squares of province-level financial development. 'Initial' denotes the lag level value of dependent variable. The underidentification test is an LM test, which is based on Kleibergen and Paap (2006) rk LM statistics with the null hypothesis that the model is underidentified. The overidentification test is based on the Hansen J test with the null hypothesis being all instruments are valid. Reported number of overidentification is p-values. For weak identification, Kleibergen-Paap rk Wald F statistics is reported.

in specifications 3 and 4, respectively.

Male ownership shows significantly positive effects on the growth rate of investment through all specifications. This implies that firms owned by males are more likely to have a higher annual growth of investment than firms owned by females, about 2.5% to 3.1%. More interestingly, the interaction term between province-level financial development and male ownership is significantly negative through all specifications and it is not affected by including the effects of year dummies. This implies that female owners are less constrained in promoting firm growth if they operate in provinces with higher financial development.

Regarding the other explanatory variables, the lagged value (initial) of investment has significant and negative effects on the growth rate of investment through all specifications. This is in accordance with the literature that proposes that the bigger firms would obtain lower growth rates than smaller firms or the higher initial values would hinder firms from obtaining high growth rates (e.g., Almus and Nerlinger, 1999; Evans, 1987; Hall, 1987; Wagner, 1995; Yang and Huang, 2005). Results also show that labour, assets (in specifications 1 and 2) and firm age have significant and positive impacts on the growth rate of investment. However, the education level of the owners does not matter for the growth rate of investment. This might be the case for developing countries as suggested in the study of Alvarez and Crespi (2003), which finds that higher education does not increase efficiency[19]. Moreover, it might be due to the fact that most of the Vietnamese firms are new establishments with an average of about four years in operation and therefore they are more likely owned by young people who are supposed to have higher levels of education. However, it would be reasonable that the young people are less likely to have higher investment for reasons such as limited business networks and lack experience in finding financial support. The effect of provincial income lacks significance except in specification 4; however the magnitude is very small.

The results for the effects on the growth rate of sales are qualitatively similar as shown in the specifications from 5 to 8. While the effects of province-level financial development are significantly positive through all specifications, the effect of male ownership is still

[19]For more details of discussion on this, see Nichter and Goldmark (2009)

positive but lacks significance in specifications 5, 6 and 8. Consistent with the previous findings on the growth rate of investment, the joint effect of province-level financial development and male ownership is significantly negative. This implies that female-owned firms could exploit the local financial development to reduce their constraints in promoting sales growth. The effect is unchanged when adding the year dummies as shown in specifications 7 and 8.

While the effects of the other explanatory variables on the growth rate of sales are similar to the effects on the growth rate of investment, assets and provincial income have opposite effects on the growth rate of sales. In particular, the level of assets negatively affects the growth rates of sales even though the magnitude is very small. This might be due to the fact that the larger firms would have lower growth rates, which is similar to the effect of the initial value as discussed above (e.g., Almus and Nerlinger, 1999; Evans, 1987; Wagner, 1995; Yang and Huang, 2005). Moreover, in provinces with a higher level of provincial per capita income, it would attract more firms to operate in the area and hence increasing the competition among firms and eventually resulting in lower sales growth.

4.5.2 The effects on firm productivity growth

As alternative measurements of firm performance, we consider firm productivities in using their resources including assets and equity. Accordingly, Table 4.4 provides the results on the effects of local financial development, male ownership, the joint effects of local financial development and male ownership, and other determinants on the growth rates of ROA and ROE. As expected, province-level financial development fosters the growth rates of ROA and ROE. Similar to the previous findings for the growth rates of investment and sales, the effect of local financial development is qualitatively unchanged when we account for the effects of year dummies. Moreover, the positive effect of male ownership on the growth rates of ROA and ROE suggests that male owners are more capable than female owners with respect to assets and equity management. However, the negative impact of the interaction term between local financial development and male ownership shows a consistent story: female-owned firms are less constrained in

promoting their firm performance when they operate in provinces with a better local financial system.

Regarding the other explanatory variables, while lagged values of dependent variables (initial condition) confirm the negative impact on the growth rates of ROA and ROE, the effect of labour is now negative compared to the effect on growth rates of sales and investment. This suggests that the more workers firms employ, the more they have to pay for labour and the less available funds they invest in improving assets and equity. As a result, that could reduce the productivity of using assets and equity. In addition, the positive effect of assets on the growth rate of ROA and ROE also confirms that the more they invest in assets, the more returns they get from it. Similar to the level of owner's education, it is obvious that a firm owner with a higher level of education will be more capable of managing assets and equity resulting in higher growth rates of ROA and ROE.

Similar to previous results, private ownership mostly shows an insignificant effect on firm performance. However, the significance in specifications 3, 4 and 8 show that firms owned by the government or foreigners perform better than private firms in terms of growth rates of ROA and ROE. However, the province-level per capita income shows mixed effects on the growth rates of ROA and ROE when we control for the effects of year dummies. The positive effects obtained in specifications 3, 4, 7 and 8 show that in provinces with better infrastructure (in accordance with higher per capita income), firms are more likely to be productive.

Moreover, firm age has a significantly negative effect on the growth rates of ROA and ROE, which is opposite to its effects on growth rates of sales and investment. As firm age represents the length of time since firms start their businesses, it would be reasonable that younger firms would be more innovative not only in production technology but also in the way of selling their products (Huergo and Jaumandreu, 2004; Rogers, 2004). Taking advantage of technology development and marketing would help them to have better opportunities than older firms to increase the growth rate of sales. In addition, operating in a longer time, older firms would have a higher volume of output and reach their maximum potential in selling products or exhausting their abilities of innovation

and resources. These would reduce their growth rates and competitive advantage in comparison with the newly established firms.

Table 4.4: The growth rates of return on asset and return on equity

	Return on asset				Return on equity			
	Hetero IV	all IV	hetero IV	all IV	hetero IV	all IV	hetero IV	all IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD1	2.648***	2.488***	0.651***	0.556***	2.284***	2.062***	0.640***	0.489***
	(0.032)	(0.029)	(0.025)	(0.024)	(0.027)	(0.024)	(0.037)	(0.033)
Male	0.044**	0.017	0.020***	0.008**	0.034*	0.017	0.013***	0.006**
	(0.020)	(0.018)	(0.003)	(0.003)	(0.018)	(0.014)	(0.003)	(0.003)
FD1*Male	−0.694***	−0.387***	−0.344***	−0.264***	−0.363***	−0.201***	−0.198***	−0.153***
	(0.089)	(0.064)	(0.024)	(0.008)	(0.088)	(0.041)	(0.022)	(0.008)
Initial	−0.989***	−0.988***	−1.012***	−1.011***	−1.023***	−1.020***	−1.042***	−1.041***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Labour	−0.130***	−0.130***	−0.131***	−0.131***	−0.074***	−0.081***	−0.096***	−0.095***
	(0.012)	(0.009)	(0.003)	(0.002)	(0.014)	(0.013)	(0.003)	(0.002)
Asset	0.165***	0.170***	0.173***	0.173***	0.095***	0.103***	0.105***	0.106***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Private ownership	−0.011	−0.026	−0.072***	−0.084***	0.022	0.015	−0.035	−0.040∗
	(0.030)	(0.025)	(0.021)	(0.020)	(0.028)	(0.025)	(0.021)	(0.020)
GDPP	−0.014***	−0.014***	0.004***	0.004***	−0.015***	−0.016***	0.002***	0.002***
	(0.005)	(0.005)	(0.001)	(0.001)	(0.005)	(0.004)	(0.001)	(0.001)
Education	0.009***	0.009***	−0.000	0.000	0.009***	0.008***	0.002*	0.002**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Firm age	−0.336***	−0.319***	−0.235***	−0.223***	−0.252***	−0.215***	−0.189***	−0.171***
	(0.058)	(0.050)	(0.009)	(0.008)	(0.052)	(0.046)	(0.008)	(0.007)
Year2010			−0.162***	−0.168***			−0.132***	−0.144***
			(0.005)	(0.005)			(0.005)	(0.004)
Year2011			0.671***	0.693***			0.535***	0.562***
			(0.008)	(0.006)			(0.011)	(0.009)
Year2012			0.129***	0.131***			0.106***	0.101***
			(0.005)	(0.004)			(0.005)	(0.004)
Constant	0.001***	0.001***	−0.173***	−0.177***	0.000	0.000	−0.134***	−0.137***
	(0.000)	(0.000)	(0.003)	(0.002)	(0.000)	(0.000)	(0.003)	(0.002)
Observations	140751	140751	140751	140751	136816	136816	136816	136816
R-squared	0.627	0.630	0.662	0.662	0.615	0.618	0.641	0.641
Underidentification	0.037	0.023	0.135	0.138	0.022	0.019	0.145	0.134
Overidenfication	0.049	0.083	0.134	0.096	0.174	0.303	0.191	0.103
Weak identification	531.787	969.515	371.620	364.136	1110.058	1188.608	277.946	273.203

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. The dependent variables are annual growth rate of ROA and ROE, which are measured from 2010 to 2013. All explanatory variables are measured from 2009 to 2012. For more details see notes to Table 4.3

4.5.3 Robustness checks

To check for the robustness of our results, we use the number of financial suppliers per square kilometre as an alternative measure for local financial development. Similar to the baseline estimation, we apply the heteroscedasticity-based identification strategy (Lewbel, 2012) and use external instruments to complement heteroscedasticity-based instruments. We also take into account the effects of initial conditions, year dummies,

and other determinants. Robustness check results are documented in Tables 4.5 and 4.6 and are qualitatively similar to our baseline results. In particular, the results show that province-level financial development fosters firm growth in terms of the growth rates of sales, investment, ROA and ROE. The results also confirm that while male-owned firms are more capable than female-owned firms in enhancing firm growth, local financial development could help reduce the gender gap in promoting firm growth.

Table 4.5: The growth rates of investment and sales

	Investment				Sales			
	Hetero IV	all IV	hetero IV	all IV	hetero IV	all IV	hetero IV	all IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD2	0.124***	0.106***	0.075***	0.018	0.427***	0.365***	0.080**	0.036
	(0.010)	(0.008)	(0.028)	(0.022)	(0.012)	(0.007)	(0.035)	(0.027)
Male	0.034***	0.028***	0.036***	0.031***	0.014***	0.007	0.020***	0.007
	(0.007)	(0.006)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
FD2*Male	−0.148***	−0.117***	−0.155***	−0.125***	−0.114***	−0.068***	−0.098***	−0.075***
	(0.042)	(0.021)	(0.020)	(0.015)	(0.035)	(0.013)	(0.017)	(0.013)
Initial	−0.971***	−0.969***	−0.968***	−0.969***	−0.953***	−0.953***	−0.957***	−0.957***
	(0.004)	(0.003)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Labour	0.129***	0.128***	0.137***	0.137***	0.116***	0.116***	0.111***	0.116***
	(0.003)	(0.003)	(0.003)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)
Asset	0.008***	0.008***	0.000	−0.000	−0.009***	−0.008***	0.002	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)
Private ownership	0.009	0.012	0.004	0.007	−0.022	−0.015	−0.033**	−0.020
	(0.016)	(0.015)	(0.015)	(0.014)	(0.017)	(0.014)	(0.015)	(0.013)
GDPP	−0.001	−0.002	0.000	0.001***	−0.005**	−0.005***	−0.001**	0.000**
	(0.001)	(0.001)	(0.001)	(0.000)	(0.002)	(0.001)	(0.001)	(0.000)
Education	−0.003***	−0.003***	−0.004***	−0.004***	−0.002**	−0.002**	−0.003***	−0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Firm age	0.049***	0.054***	0.047***	0.045***	−0.010	−0.001	0.021**	0.009∗
	(0.014)	(0.013)	(0.009)	(0.006)	(0.025)	(0.016)	(0.010)	(0.005)
Year2010			−0.009**	−0.013***			0.011	0.011**
			(0.004)	(0.004)			(0.007)	(0.006)
Year2011			0.034***	0.044***			0.160***	0.172***
			(0.007)	(0.005)			(0.007)	(0.006)
Year2012			−0.031***	−0.031***			0.063***	0.061***
			(0.003)	(0.003)			(0.003)	(0.003)
Constant	0.000***	0.000***	0.000	−0.001	0.003***	0.003***	−0.057***	−0.060***
	(0.000)	(0.000)	(0.002)	(0.002)	(0.000)	(0.000)	(0.003)	(0.003)
Observations	137782	137782	137782	137782	140874	140874	140874	140874
R-squared	0.550	0.550	0.550	0.551	0.571	0.571	0.573	0.573
Underidentification	0.018	0.028	0.067	0.108	0.033	0.017	0.069	0.109
Overidenfication	0.194	0.261	0.429	0.367	0.113	0.222	0.326	0.109
Weak identification	231.723	461.467	215.795	302.505	234.341	572.860	247.032	340.020

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. 'FD2' and 'FD22' denotes the level and square of province-level financial development, respectively. For more details see notes to Table 4.3.

Table 4.6: The growth rates of return on asset and return on equity

	Return on asset				Return on equity			
	Hetero IV	all IV	hetero IV	all IV	hetero IV	all IV	hetero IV	all IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD2	2.599***	2.388***	0.656***	0.541***	2.244***	1.971***	0.642***	0.462***
	(0.034)	(0.031)	(0.026)	(0.025)	(0.029)	(0.025)	(0.039)	(0.035)
Male	0.053**	0.021	0.022***	0.009***	0.037**	0.017	0.016***	0.009***
	(0.021)	(0.017)	(0.003)	(0.003)	(0.018)	(0.013)	(0.003)	(0.003)
FD2*Male	−0.638***	−0.330***	−0.324***	−0.238***	−0.328***	−0.161***	−0.195***	−0.145***
	(0.087)	(0.051)	(0.023)	(0.006)	(0.081)	(0.031)	(0.019)	(0.006)
Initial	−0.990***	−0.988***	−1.012***	−1.011***	−1.023***	−1.020***	−1.042***	−1.041***
	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Labour	−0.127***	−0.129***	−0.132***	−0.131***	−0.072***	−0.082***	−0.097***	−0.095***
	(0.012)	(0.011)	(0.003)	(0.002)	(0.014)	(0.013)	(0.003)	(0.002)
Asset	0.164***	0.172***	0.173***	0.174***	0.094***	0.105***	0.105***	0.106***
	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)
Private ownership	−0.009	−0.025	−0.071***	−0.080***	0.021	0.012	−0.036∗	−0.038∗
	(0.030)	(0.025)	(0.021)	(0.020)	(0.029)	(0.025)	(0.022)	(0.021)
GDPP	−0.019***	−0.017***	0.004***	0.004***	−0.019***	−0.019***	0.001***	0.002***
	(0.006)	(0.005)	(0.001)	(0.001)	(0.005)	(0.004)	(0.001)	(0.000)
Education	0.009***	0.008***	−0.000	0.000	0.009***	0.008***	0.002	0.002**
	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)
Firm age	−0.331***	−0.317***	−0.242***	−0.226***	−0.253***	−0.213***	−0.197***	−0.175***
	(0.063)	(0.052)	(0.010)	(0.009)	(0.054)	(0.047)	(0.008)	(0.007)
Year2010			−0.160***	−0.168***			−0.132***	−0.147***
			(0.005)	(0.005)			(0.005)	(0.004)
Year2011			0.669***	0.693***			0.533***	0.564***
			(0.009)	(0.007)			(0.011)	(0.009)
Year2012			0.129***	0.130***			0.105***	0.100***
			(0.005)	(0.004)			(0.005)	(0.004)
Constant	0.001***	0.001***	−0.172***	−0.177***	0.000	0.000	−0.134***	−0.137***
	(0.000)	(0.000)	(0.003)	(0.002)	(0.000)	(0.000)	(0.003)	(0.002)
Observations	140751	140751	140751	140751	136816	136816	136816	136816 D
R-squared	0.628	0.631	0.662	0.662	0.615	0.618	0.641	0.641
Underidentification	0.025	0.029	0.159	0.137	0.017	0.015	0.185	0.131
Overidenfication	0.056	0.086	0.116	0.096	0.156	0.275	0.176	0.108
Weak identification	310.614	515.359	346.461	317.926	661.131	570.196	230.329	243.058

Notes: Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1 percent, 5 percent and 10 percent is indicated by ***, **, and *, respectively. For more details see notes to Table 4.4.

4.6 Conclusions and policy implications

In this paper, we examine the gender gap in exploiting the local financial development at the province level in promoting firm growth in Vietnam. The results are robust to the use of different measures of province-level financial development and when applying the recently suggested method of identification through heteroscedasticity. This study contributes to the literature as, to the best of our knowledge, this is the first study to clarify the difference between male-owned and female-owned firms in exploiting the level of province-level financial development to promote firm growth.

Applying a heteroscedasticity-based identification strategy on large Vietnamese firm-level data covering the period 2009-2013, our results reveal that: First, similar to previous findings, province-level financial development significantly fosters firm growth in terms of growth rates of sales, investment, ROA and ROE. Second, male-owned firms are more capable than female-owned firms in terms of promoting the growth rates of sales, investment, ROA and ROE. However, in terms of exploiting the growth-promoting role of local financial development, the results imply that firms owned by females are less constrained in promoting firm performance if they operate in provinces with higher financial development. Our results are unchanged if we control for the effects of year dummies and use the standard instruments to complement heteroscedasticity-based instruments. Moreover, the results are qualitatively similar and robust to the use of alternative measures of province-level financial development.

Our findings have several policy implications. We suggest that policy makers should exploit the development of province-level finance such as facilitating the availability of local financial suppliers. As a result, this would benefit firms in terms of increasing their growth. Moreover, policy makers should create appropriate environments to encourage the start-up or leadership of women in business. This would not only reduce the discrimination between male and female in business and society but also foster economic growth as taking advantage of women's ability in exploiting the growth-promoting role of local finance.

5 Local financial development and firm growth: Evidence from Vietnam

Viet T. Tran, Yabibal M. Walle and Helmut Herwartz

Abstract. This paper examines whether heterogeneities in financial development among Vietnamese provinces matters for firm growth in Vietnam. Using a nationally representative panel survey that covers about 41,000 firms for the period 2009—2013, we estimate the causal impact of province-level financial development on firm growth by accounting for sectoral differences in growth opportunities. We find that local financial development promotes the growth rates of sales, investment and sales per worker of small firms, and reduces the growth rate of wage per sales. Our results imply that, in sectors with growth opportunities, firms operating in a financially developed locality grow faster than firms located in provinces with a lower level of financial development. Moreover, the difference in growth rates of firms operating in sectors with stronger growth opportunities and firms in sectors with lower growth opportunities is larger if these firms are located in localities with higher financial development.

5.1 Introduction

The impact of financial development on economic growth has been intensively discussed in the past three decades. While a large body of empirical research suggests that financial development is growth promoting (e.g., Goldsmith, 1969; King and Levine, 1993; Levine et al., 2000), there are studies which show that either causality runs from economic growth to financial development (e.g. Ang and McKibbin, 2007), or the link between finance and growth is fragile (Andersen and Tarp, 2003). More recent studies document that the finance-growth link depends on other economic and institutional factors (e.g. Arestis and Demetriades, 1997; Herwartz and Walle, 2014a). Likewise, Arcand et al. (2015) suggest that the impact of finance on growth could be negative if the ratio of credit to the private sector to GDP exceeds a threshold of 80 to 100%.[20]

[20]For more details on the finance-growth debate, see Levine (2005) and Panizza (2014).

While several studies have intensively investigated the impact of financial development on economic growth in cross-country frameworks, recent contributions to this literature have focused on examining the effects of local financial development on sub-national economic development. Extant studies have generally shown that local financial development matters for local economic growth. For instance, Guiso et al. (2004) report a positive impact of region-level financial development on firm growth in Italy. Kendall (2012) finds a positive effect of district-level banking sector development on regional economic growth in India. Likewise, Gloede and Rungruxsirivorn (2013) and Tran et al. (2018) document that local financial development promotes household welfare in Thailand and Vietnam, respectively. At a more disaggregated level, Fafchamps and Schündeln (2013) find a positive impact of commune-level financial development on the performance of small and medium-sized firms in Morocco. Due to the peculiarities of financial systems across countries, however, many more country-specific studies are needed to generalise that local financial development is good for local economic development in most, if not all, countries.

In this paper, we examine whether local (province-level) financial development improves the growth of small firms in Vietnam. The study covers more than 41,000 Vietnamese firms for the period 2009-2013. The data are obtained from the Vietnamese Enterprise Survey (VES), which is a representative firm level survey administered annually by the General Statistics Office of Vietnam. We measure local financial development by the number of financial suppliers per 1000 people in a given province. As a robustness check, we also consider the number of financial suppliers per square kilometre.

Our paper is related to the study by O'Toole and Newman (2017), who employ VES data to examine if provincial financial development eases Vietnamese firms' constraints in accessing external finance. They report that financial development reduces external financing constraints and therefore facilitates investment. While O'Toole and Newman (2017) focus on showing the channel though which local financial development promotes investment (i.e., by alleviating financial constraints), we examine the overall impact of local financial development in firm growth in terms of sales, investment and productivity.

The other difference between the present paper and that of O'Toole and Newman (2017) is that while O'Toole and Newman (2017) drop firms with negative growth opportunities, our approach fully accounts for sectoral differences in growth opportunities. Fisman and Love (2007) have shown that, anticipating growth in sectors with better growth opportunities, financial institutions extend more credit for firms in those sectors and the high correlation between credit extended to those firms and their growth rates may not reflect a causal impact of financial development on firm growth. Instead, it may simply proxy the effect of other confounding factors that created growth opportunities in those sectors. Hence, Fisman and Love (2007) suggest that studies examining the impact of financial development on firm growth should control for sectoral differences in growth opportunities. This methodological advance is introduced into the micro-level finance-growth literature by Fafchamps and Schündeln (2013), who examine the impact of commune-level financial development on the growth of small and medium-sized firms in Morocco by accounting for sectoral differences in growth opportunities. Unlike O'Toole and Newman (2017), but similar to Fafchamps and Schündeln (2013), the present study estimates the causal impact of local financial development on firm growth in Vietnam by explicitly accounting for growth opportunities of each sector and interacting it with our local financial development indicator.

Our results show that province-level financial development has positive impacts on the growth of small firms in Vietnam. In particular, while province-level financial development promotes the growth rates of sales, sales per worker and investment, it reduces the growth rates of wage per sales. As we have controlled for growth opportunities, our results imply that small firms operating in a financially developed locality grow faster than those firms in sectors with the same level of growth opportunities but located in localities with a lower level of financial development. Moreover, the difference in growth rates of firms operating in sectors with stronger growth opportunities and firms in sectors with lower growth opportunities is larger if these firms are located in localities with higher financial development.

In Section 5.2, we briefly review the literature on the finance-growth nexus and provide a brief overview of the Vietnamese financial system. We outline the estimation

methodology in Section 5.3 and provide the descriptive statistics of the data in Section 5.4. The main results and robustness checks are discussed in Section 5.5. Section 5.6 concludes with the main findings. Robustness check results are provided in Appendix 5.7.

5.2 Literature review

In this section, we first provide a brief review of the literature on the impact of country-level financial development on macro- and micro-level economic development. Subsequently, we review empirical studies that examine the relationship between local financial development and economic growth. As our focus is on Vietnam, we conclude this section with an overview of the Vietnamese financial system.

5.2.1 Country-level financial development and economic growth

At the macro level, a large number of studies have examined the relationship between financial development and economic growth. Although Goldsmith (1969) does not explore the causal direction between finance and growth, he documents a positive correlation between financial development and economic growth. Based on empirical evidence from many countries (Argentina, Brazil, Chile, Germany, Korea, Indonesia and Taiwan after the Second World War), McKinnon (1973) concludes that better financial systems contribute to faster economic growth. King and Levine (1993) examine the same issue as Goldsmith (1969) with more careful control for other determinants of economic development. Using data covering 80 countries from 1960 to 1989, they document a strong impact of financial development on the growth rates of GDP per capita, physical capital accumulation and efficiency.

Many studies use the ratio of credit to the private sector to GDP or the ratio of credit to the private sector plus total value traded in stock market to GDP as a main measure of financial development. Measuring financial development by means of total share's value traded in stock market, Levine and Zervos (1998) confirm that, in the long-run, stock market liquidity enhances economic growth. Moreover, Levine et al. (2000) exploit a range of instrumental variables approaches to address endogeneity issues in

investigating the causal impact of finance on growth. Estimation results using data from 71 countries for the period 1960–1995 show that financial development fosters economic growth.

Although most empirical studies report that financial development plays an important role in improving economic growth, there are some studies which contradict this conclusion. For instance, Ang and McKibbin (2007) document that economic growth causes financial development and not vice versa. There are also some studies that question the existence of a meaningful finance-growth nexus (e.g. Lucas, 1988; Andersen and Tarp, 2003). Moreover, Herwartz and Walle (2014a) show that the finance-growth nexus could depend on certain economic and institutional factors, such as the level of economic and financial development. Similarly, a recent study by Arcand et al. (2015) shows the positive effect of intermediate levels of financial development on economic growth, but the impact becomes negative when the ratio of credit to the private sector to GDP reaches a threshold level of 80–100%.

Studies have also examined the impact of country-level financial development on micro (industry and firm) level economic development. For instance, Demirgüç-Kunt and Maksimovic (1996) investigate the effect of country-level financial development on firm growth using firm-level data from 30 countries. They report that access to stock market and well-developed legal systems could increase the likelihood of firms to get external fund and grow faster. Rajan and Zingales (1998) suggest a way of dealing with the finance-growth causality by means of an indicator of external financial dependence. They argue that industries that depend heavily on external finance should benefit disproportionately more from higher financial development than industries that do not rely on external finance. Using data from US industries to measure the need for external finance in each industry, results based on a large sample of countries in the 1980's show that industries relying on external finance grow faster in economies with better financial development.

Beck et al. (2000) investigate the effect of financial structure on economic development at the firm, industry and country levels. Measuring financial development by means of finance-activity, which is the combination of bank indicators (private credit)

and stock market indicators (total shares' value traded), they document that financial development enhances long-term growth rates, promotes industries with relatively high dependence on external finance and improves the performance of firms with demand for credit. Moreover, exploring the effects of financial, legal and corruption problems on growth of firms with different sizes, Beck et al. (2005) conclude that financial development alleviates the firms' constraints, with the smallest firms benefiting the most from financial development.

To address the endogeneity between finance and growth more carefully, Fisman and Love (2007) revisit the evidence in Rajan and Zingales (1998) by proposing the concept of growth opportunities. They argue that, as financial institutions might direct more finance to sectors with better growth opportunities, a strong correlation between finance and growth might not indicate a causal impact of finance on growth. To address this concern, they suggest controlling for growth opportunities, i.e., comparing firms with similar growth opportunities but being located in countries with different levels of financial development. Using the same data set as in Rajan and Zingales (1998), and employing the growth rates of US sectors as a proxy for global growth opportunities, Fisman and Love (2007) conclude that industries with better growth opportunities grow faster in countries with well-developed financial systems. Moreover, they document that the effect of growth opportunities encompasses the effect of external finance dependence, which was used in Rajan and Zingales (1998).

5.2.2 Local financial development and economic growth

While most empirical studies in the finance-growth literature focus on cross-country variations in financial development, a few works investigate the effect of within-country heterogeneity in financial development on economic growth. Focusing on regional heterogeneity in financial development, Jayaratne and Strahan (1996) study the relationship between intrastate branch banking reform and per capita growth in the US over the period 1970s and 1980s. They document that changes in the banking system, especially bank lending quality, is responsible for faster economic growth. Guiso et al. (2004) examine the relationship between regional financial development and firm

performance in Italy. They find that local financial development enhances firm growth, promotes competition and favours the entry of new firms. Similarly, Dehejia and Lleras-Muney (2007) examine the effects of the state-level banking regulation and financial development on the state-level economic growth in the US using data from 1900 to 1940. The results show that financial expansion, which is induced by bank branching, fosters mechanization in agriculture and spurs growth in the manufacturing sector.

Using panel data on Vietnamese provinces over the period 1997 to 2006, Anwar and Nguyen (2011) examine the impact of provincial financial development, which is measured by the ratio of credit to the private sector to gross provincial products, on provincial economic growth. They document that provincial financial development accelerates economic growth at the province level. Similarly, O'Toole and Newman (2017) exploit an extensive firm-level data set in Vietnam to investigate the role of provincial financial development in reducing external financing constraints faced by firms. The results show that provincial financial development mitigates the financing constraints of firms and facilitates investment activity.

At the sub-province levels, Kendall (2012) examine the effects of banking sector development and human capital at the district-level on economic growth in India. They document that district-level financial development, which is measured by the percentage of bank credit to net domestic product (NDP), positively affects economic growth at the district level. Furthermore, banking depth has a non-linear effect on growth and the effect is more than double if the ratio of bank credit/NDP in the district is below the median. Similarly, Gloede and Rungruxsirivorn (2013) study the impact of district-level financial development on household welfare in Thailand in 2007. They find that local financial development has positive effects on productive investment, agricultural revenue and household consumption. Tran et al. (2018) study the role of local financial development in household welfare in Vietnam. Employing the recently suggested method of identification through heteroscedasticity to address endogeneity concerns, they find that district, sub-district and village level financial development has a positive impact on household annual income, consumption and consumption smoothing.

Fafchamps and Schündeln (2013) consider the impact of commune-level financial

development on firm performance in Morocco from 1998 to 2003. Their findings show that, at the commune level, bank availability robustly enhances growth rates of small and medium-sized firms in sectors with growth opportunities. Moreover, the availability of bank branches at the commune level reduces the likelihood of firm exit, encourages entry of new firms and promotes investments.

5.2.3 The Vietnamese financial sector

Prior to the commencement of the renovation period (1986), known as Doi Moi, the Vietnamese government dominated the whole banking system in the centrally planned economy. Established in 1951, the State Bank of Vietnam (SBV) acted as a single-tier bank. The SBV provided almost all domestic banking services including issuing money as a central bank and raising and lending funds as a commercial bank. The state also controlled two specialized banks, namely, State Owned Commercial Banks (SOCBs) including the Bank for Investment and Development of Vietnam (BIDV) and the Bank of Foreign Trade of Vietnam (Vietcombank or VCB). Established in 1957, the BIDV was in charge of providing long-term capital to the public expenditure and infrastructure projects. The Vietcombank was founded in 1963 and was responsible for financing foreign trade, managing financial exchange and supporting the State Owned Enterprises (SOEs) (Tran et al., 2015).

In 1986, Vietnam initiated a renovation period, implementing major reforms in the economy and the financial sector. Accordingly, the banking system was separated into two: the central bank (SBV) and SOCBs. Moreover, the government established two more SOCBs, namely, Vietnam Bank for Agriculture and Rural Development (VBARD) and the Industrial and Commercial Bank of Vietnam (formerly Incombank or CTG, now Vietinbank). The reform policy also allowed private entities to borrow and raise funds from the public, which led to the establishment of credit funds and credit cooperatives, which is later renamed as People's Credit Funds after the crisis in 1990 (Tran et al., 2015).

Currently, the Vietnamese financial sector is large by lower middle-income economy standards, with total assets amounting to 200% of GDP in 2011 (World Bank, 2014). The

sector is still dominated by a large banking sector, with non-bank financial institutions accounting for only 8% of financial institution assets. As of 2014, the banking sector in Vietnam comprises five SOCBs, 33 joint stock commercial banks (JSCBs), five joint venture banks and five wholly foreign-owned banks (Tran et al., 2015). The total asset of the banking sector is 183% of GDP and accounts for 92% of financial institutions' assets (World Bank, 2014). Among SOCBs, Agribank has the largest operating networks with around 2,400 branches and units nationwide. Vietinbank, BIDV, and VCB have, respectively, about 1123, 725 and 328 branches and units (Tran et al., 2015). Despite subsequent reforms to liberalise the financial sector, there is still a large state presence in the banking sector. The five SOCBs accounted for almost 40 percent of the banking sector's assets and 48 percent of deposits in 2011. The state has also shares in several of JSCBs and owns large SOEs (World Bank, 2014).

As Figure 5.1 shows, Vietnam's banking sector development as measured by the percentage of domestic credit to the private sector, which is around 100%, is at a lower than that of China, Malaysia and Thailand but better than that of Cambodia and Laos. With slightly more than three bank branches per 100, 000 adults, however, access to finance lags significantly behind regional levels, where, for instance, Malaysia and Thailand have more than 10 bank branches per 100, 000 adults.

Vietnam has a small but growing equity market, with a capitalization rate of about 19% of GDP in 2011 (World Bank, 2014). The two stock exchanges, the Ho Chi Minh Stock Exchange (HSX) and Hanoi Stock Exchange (HNX) are established in 2000 and 2005, respectively. They have more than 700 listed companies by the middle of 2016. Still, SOEs account for about one-third of all companies listed in the stock exchanges. Finance companies are the largest non-bank financial institutions in Vietnam. In 2014, they accounted for about 6% of GDP and 3% of all financial institutions' asset. The other notable non-bank financial institutions include insurance companies and mutual funds, each constituting 4% and less than 1% of GDP (World Bank, 2014), respectively.

In sum, although existing studies confirm that local financial development matters for local economic development, they are few in number and may only reflect the particularities of the economies under study. As the Vietnamese financial system has

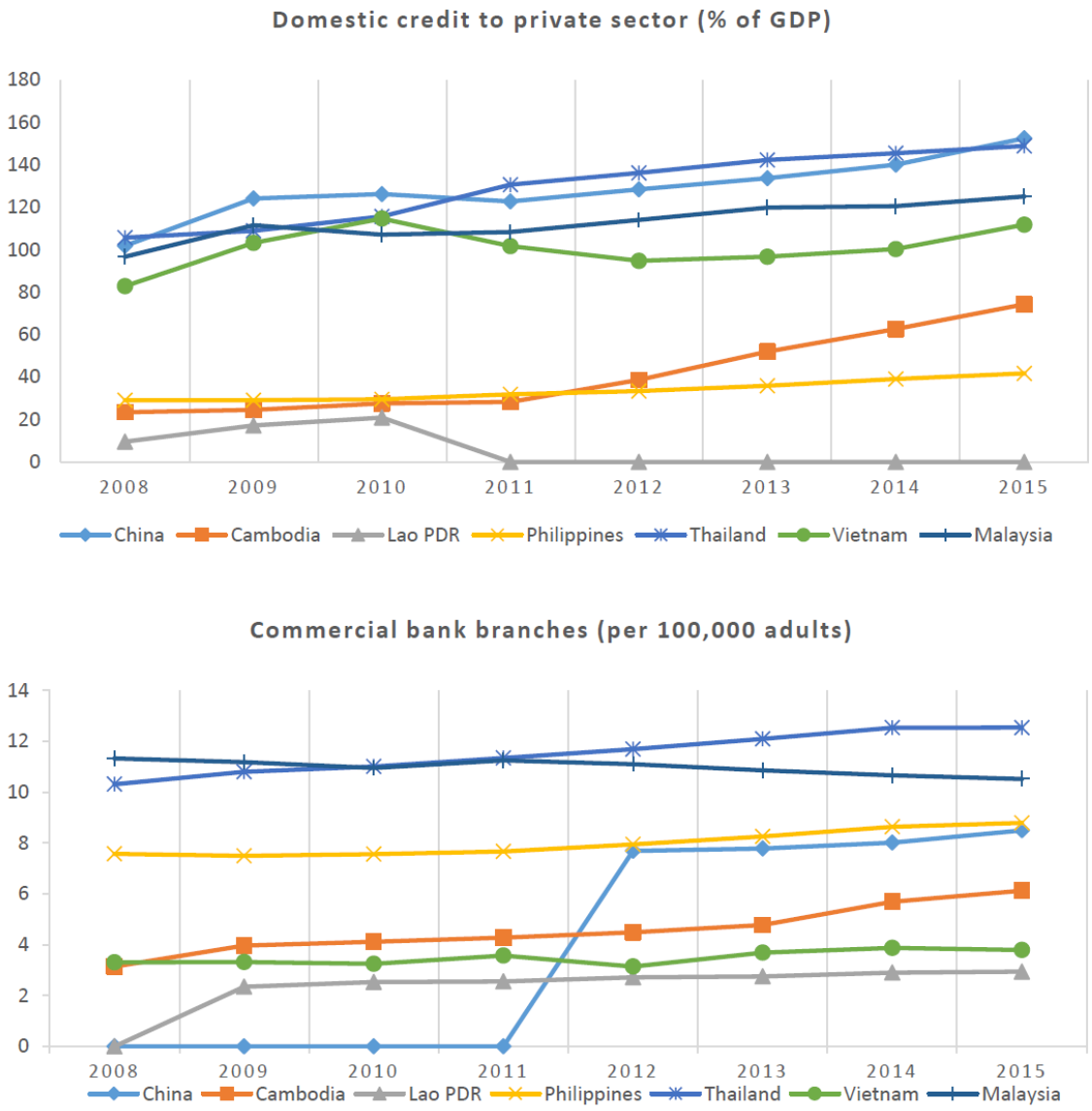

Figure 5.1: Financial development indicators of Vietnam and other Asian economies.
Notes: Data of Lao PDR from 2011 and China before 2011 are not available.
Source: Global Financial Development, The World Bank (2018)

passed through its own development path with a markedly high degree of government intervention, a separate study based on Vietnamese data is needed to establish the impact of local financial development on firm performance in Vietnam.

5.3 Estimation strategy

As the appearance of financial suppliers partly depends on the performance of firms in the region, endogeneity is a serious concern in estimating the impact of local financial development on firm growth. To address this problem, we follow the strategy first suggested in Fisman and Love (2007) and later adopted to the local financial development research by Fafchamps and Schündeln (2013). As in Fafchamps and Schündeln (2013), we take into account the fact that large firms should react to growth opportunities better than small firms as they are less likely to be constrained by access to credit (Beck et al., 2005).

There are several reasons why being a large firm could bring more advantages in accessing finance than being a small firm. Firstly, large firms are more likely to operate in a broader area which could cover several districts and provinces. This would bring them more opportunities to access finance because they will have better relationships and more connections with financial suppliers operating not only in their own locality but also in other localities (Fafchamps and Schündeln, 2013). Secondly, from the side of financial suppliers, it is often easier to obtain information about large firms than small firms. Thus, financial suppliers can better evaluate the loan applications of large firms than small firms (Petersen and Rajan, 2002). Thirdly, in comparison with small firms, large firms have more assets and hence could provide more collateral, which is often very crucial in obtaining loans from financial suppliers.

Using data for financially less constrained firms, i.e firms with more than 50 employees, we calculate growth opportunities based on sales growth from 2009 to 2013 for 18 sectors in Vietnam. The classification of sectors or industries is obtained from the Vietnam Standard Industrial Classification 2007 (VSIC2007), which in turn is based on the classification of the United Nation's Statistical Division. While our preferred group of 'large firms' is the group of firms with more than 50 employees, we also use the group of firms with more than 100 employees as an alternative 'large firms' group.[21] We calculate

[21]For the latest survey on Vietnamese firms in 2015, the World Bank classified Vietnamese firms with more than 100 employees as large firms. However, noting the fact that the majority of firms in Vietnam are small firms with less than 20 employees, using the firms with more than 50 employees as a reference group could be more appropriate.

growth opportunities (GO) for each sector s as

$$GO_s = ln(\sum_{f=1}^{Ns,t1} Sales_{f,t1}) - ln(\sum_{f=1}^{Ns,t0} Sales_{f,t0}), \tag{5.1}$$

where f denotes large firms, Ns refers to the number of large firms in sector s, ln represents the natural logarithmic transformation, and the time indices $t0$ and $t1$ denote the years 2009 and 2013, respectively. In order to avoid spurious results driven by firms moving across size and sectors between 2009 and 2013, we use those firms that were classified as 'large firms' (more than 50 or 100 employees, alternatively) in 2009 and still existing in the same sector until 2013. In other words, we do not consider firms that have changed sectors during this period or that are new in 2013.

Growth rates of small firms (firms with less than 20 employees, which account for more than 90% of Vietnamese firms) from period $t0$ to $t1$ are defined as

$$\Delta y_{fis} = y_{fis,t1} - y_{fis,t0}, \tag{5.2}$$

where y_{fis} refers to either sales, investment, sales per worker or wage per sales (in natural logarithms) of firm f in locality i and sector s.

Accordingly, our estimation model is of the following form

$$\begin{aligned} \Delta y_{fis} = \beta_1 FD_{i,t0} GO_s + \beta_2 y_{fis,t0} + \beta_3 FD_{i,t0} y_{fis,t0} + \\ X_{fis,t0}\gamma + \mu_i + v_s + e_{fis}, \end{aligned} \tag{5.3}$$

where $FD_{i,t0}$ is local financial development in locality i in 2009; GO_s is the growth opportunities of sector s from 2009 to 2013; $X_{fis,t0}$ is a vector of explanatory variables for firm, sector and local characteristics in 2009; μ_i is a vector of local dummies; v_s is a vector of sector dummies; and e_{fis} is the error term.

Following Fisman and Love (2007) and Fafchamps and Schündeln (2013), we hypothesise that small firms will grow faster in locations with higher financial development when they operate in sectors with growth opportunities. Similarly, as the demand for external credit is low in sectors with low growth opportunities, local financial development may not affect firm performance in those sectors. Thus, when firm

performance is measured by means of the growth rates of sales, investment and sales per worker, we expect a positive β_1 which implies that local financial development promotes firm performance in the presence of strong growth opportunities. It also implies that, in a location with better financial development, the difference in growth rates between firms in a sector with higher growth opportunities and firms in a sector with lower growth opportunities is larger than the difference in growth rates between the firms of these same sectors located in a location with lower financial development. With regard to the growth rate of wage per sales, the coefficient β_1 is expected to be negative as we expect local financial development to increase efficiency of using labour.

5.4 Summary statistics

This section provides summary statistics for the data used in this study, including the measures for local financial development and growth opportunities.

5.4.1 Data description

Table 5.1 documents summary statistics for the sample used for estimation (small firms only). Panel A of Table 5.1 gives information about firm level characteristics for small firms with less than 20 employees in 2009. On average, each firm has about 4.6 billion Vietnamese Dong (VND)[22] of sales and sales range from 0 to more than 785 billion VND. The average value of total assets per firm is about 8.3 billion VND. The average unit of labour employed by each firm is about 6 people while the average wage is 35.6 million VND. Moreover, investment for producing goods and services ranges from 0 million to 674 billion VND, with the average investment per firm being about 4 billion VND. Among the total of 41,398 firms in 2009, 34.3% are purely private firms that are not even partially owned by the government or foreigners.

Panel A of Table 5.1 also documents summary statistics for our dependent variables: real growth rates over the period 2009–2013 of sales, investment, sales per worker and wage per sales. The average growth rate of sales per firm is about 23% while the average growth rate of sales per worker, which proxies productivity of labour, is about 26.9%.

[22]In 2009, one US dollar equals to 17,065 Vietnamese Dong (World Bank, 2009).

Similarly, the average growth rates of investment and wage per sales are 24.9% and -17.3%, respectively.

Table 5.1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: Firm-level characteristics (Small firms)					
Total sales$^{(a)}$	39,617	4.674	18.527	0	785.530
Asset$^{(a)}$	41,398	8.309	22.695	0	861.886
Wage$^{(b)}$	41,398	35.661	43.183	1	4,158.000
Investment$^{(a)}$	41,398	4.053	16.538	0	673.985
Labour	41,398	6.573	3.610	1	19
Private	41,398	0.343	0.475	0	1
Growth of Sales	33,117	0.230	2.038	-13.127	11.710
Growth of Investment	34,792	0.249	2.261	-11.631	11.726
Growth of Sales per worker	33,117	0.269	1.947	-14.845	11.869
Growth of Wage per Sales	33,117	-0.173	1.979	-11.808	15.117
Panel B: Province and sector-level characteristics					
Province-level GDP$^{(a)}$	39	40,394.890	62,716.910	7,531.937	347,480.700
Province-level income per capita$^{(b)}$	39	21.981	27.056	9.329	180.439
Population of province	39	1,722.131	1,330.854	598.600	7,196.100
Size of province in km2	39	4,787.426	3,517.391	926.000	16,490.000
Population density	39	0.576	0.622	0.105	3.434
Sector VA$^{(a)}$	39	310.321	1,659.707	-4,630.442	8,111.745
Sector employment	39	27.227	72.082	0.510	329.166
Labour employed in province	39	195.660	374.022	30.045	1,920.796
Average wage in province by sector$^{(b)}$	39	24.568	9.052	17.403	68.749
VA sector/local	39	0.495	2.390	-0.092	15.010
Province labour/province population	39	0.010	0.013	0.000	0.051
Sector labour/province labour	39	0.018	0.024	0.001	0.096

Note: The values for all variables except the growth rates of sales, investment, sales per worker and wage per sales refer to the year 2009. The superscripts (a) and (b) indicate that variables are measured in billion and million VND respectively. All monetary values are in constant 2009 prices.

Panel B of Table 5.1 presents province- and sector-level characteristics, which will be used as proxies for provincial economic development. Provincial income per capita in 2009 varies from 9.3 million to 180 million VND, with the average being about 22 million VND. The average provincial total population, total area and population density are about 1.7 million, 4787 km2 and 576 people per square kilometre, respectively. The table also provides the sector-level characteristics and their roles in each province. On average, total sector value added per province is about 310 billion VND and each sector has about 27 workers. The average wage is 24.6 million VND per year. In terms of the contribution of sectors to the economic development of provinces, the share of total value added by firms in a sector to the total value added of province is about 49.5% while the share of workers employed by a sector to the total number of workers in a province is

1.8%.

5.4.2 Financial development indicators

Following Fafchamps and Schündeln (2013) we measure local financial development by means of the availability of financial suppliers at the province level. Seeking external credit from financial suppliers available in the province where the firms are located is often easier than seeking credit from suppliers in farther localities. This is because applying for credit from financial suppliers in remote areas would not only cause transaction costs but also increase the likelihood of their applications getting rejected by financial suppliers who would have less information about these firms than about firms in their localities.

Table 5.2: Financial development indicators

Panel A: Summary statistics					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Number of financial supplier per 1000 capita (FDP1)	39	0.021	0.021	0.001	0.107
Number of financial supplier per 1 km2 (FDP2)	39	0.020	0.043	0.000	0.224
Panel B: Correlation					
			FDP1		
FDP2			0.805*		

Note: (*) indicates the significant at 1% level.

Panel A of Table 5.2 documents the descriptive statistics for our two financial development indicators: the number of financial suppliers per 1000 people and the number of financial suppliers per square kilometre in localities, in 2009. The former one is our main local financial development indicator while the latter is used for a robustness check. Local financial development measured by the number of financial suppliers per 1000 people is used to show the possible congestion in accessing finance at the local level. It is presumable that a larger number of financial suppliers per capita at localities is associated with a lower level of competition for credit among small firms in the locality, and hence reflects a higher degree of access to finance for small firms.

Table 5.2 shows that on average there are about 2.1 financial suppliers per 100,000 people at the province level. Similarly, measuring local financial development by the number of financial suppliers per kilometre square would control for transaction costs in

visiting financial suppliers. It would be easier for firms to apply for credit if the density of financial suppliers in the locality is higher. We can see that there are about 2 financial suppliers per 100 square kilometre at the province level. Moreover, the two measures of financial development are positively correlated as shown in Panel B of Table 5.2.

5.4.3 Growth opportunities

Table 5.3 provides a summary of growth opportunities for each sector in Vietnam from 2009 to 2013 as defined in (1) and shows growth opportunities of 18 sectors based on our reference group of firms with more than 50 and 100 employees. We can see that 15 out of 18 sectors have positive growth opportunities if we use GO50 while there are four sectors showing negative growth opportunities if we use GO100 (sector F, H, L and sector S), which is expected for an emerging economy like Vietnam, where sectors have not grown to their full capacity. The growth opportunities (GO50) of all sectors ranges from -0.371 to 0.439, with manufacturing having the highest growth opportunities while other service activities has the least growth opportunities. The similarity is found with GO100 when manufacturing gets the highest growth opportunities at 0.451 and the lowest growth opportunities is belong to other service activities at -0.452. Moreover, the manufacturing sector also has the largest number of firms and the other service activities get the lowest number of firms in both years 2009 and 2013.

Table 5.3: Growth opportunities

Code	Industry name	Number of firms	GO50	Number of firms	GO100
A	Agriculture, forestry and fishing	614	0.121	270	0.104
B	Mining and quarrying	325	0.149	176	0.149
C	Manufacturing	8,530	0.439	5,636	0.451
D	Electricity, gas, steam and air conditioning supply	57	0.360	35	0.377
E	Water supply, sewerage and waste management	169	0.326	137	0.322
F	Construction	3,949	-0.050	2,154	-0.057
G	Wholesale, retail trade and repair vehicles	1,887	0.064	761	0.089
H	Transportation and storage	1,012	0.066	523	-0.006
I	Accommodation and food service activities	478	0.034	236	0.011
J	Information and communication	151	0.087	68	0.043
K	Financial and insurance activities	142	0.149	96	0.139
L	Real estate activities	170	-0.338	73	-0.433
M	Professional, scientific and technical activities	427	0.089	165	0.075
N	Administrative and support service activities	365	0.185	215	0.206
P	Education	63	0.257	35	0.266
Q	Human health and social work activities	82	0.405	44	0.385
R	Arts, entertainment and recreation	95	0.065	49	0.020
S	Other service activities	18	-0.371	10	-0.452
	Total number of firms	18,534		10,683	

Notes: With GO50, the 25th and 75th percentile are belong to sector G and sector P with growth opportunities of 0.064 and 0.257, respectively. Similarly, with GO100, the 25th and 75th percentile are belong to sector I and sector P with growth opportunities of 0.011 and 0.266, respectively.

5.5 Empirical results

In this section, we discuss estimation results on the impact of province-level financial development on the performance of firms as measured by the growth rates of total sales, investment, sales per worker and wage per sales. Noting that the majority of Vietnamese enterprises are small (more than 90% of the firms have less than 20 employees), we focus on firms with less than 20 employees and GO50 might be more appropriate to proxy growth opportunities than GO100. Our variable of interest is the interaction term between local financial development and growth opportunities. Moreover, all specifications include province and sector fixed effects.

5.5.1 Sales growth

In our data, sales is measured by the total revenue from all products and services received by the firm. Table 5.4 documents the results on the effect of provincial financial development on sales growth of small firms. Specifications (1), (2), (3) and (4) are based on growth opportunities of firms with more than 50 employees (GO50), while specifications from (5) to (8) use growth opportunities based on firms with more than 100 employees (GO100). We begin with parsimonious specifications and subsequently

add more explanatory variables at the firm, sector and province levels. Our discussions will be based on the full model specifications in columns (4) and (8) of Table 5.4.

Table 5.4: The effect of local financial development on sales growth

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	0.569***	0.364**	0.364**	0.364**	0.448***	0.258*	0.254*	0.254*
	(0.163)	(0.163)	(0.169)	(0.169)	(0.133)	(0.135)	(0.139)	(0.139)
Sales	-0.373	-0.390	-0.389	-0.389	-0.379	-0.397	-0.397	-0.397
	(0.277)	(0.273)	(0.273)	(0.273)	(0.276)	(0.272)	(0.272)	(0.272)
Sales*FD	0.064	0.062	0.062	0.062	0.061	0.060	0.060	0.060
	(0.062)	(0.061)	(0.061)	(0.061)	(0.062)	(0.060)	(0.060)	(0.060)
Private*FD		-0.025**	-0.025**	-0.025**		-0.027**	-0.027***	-0.027***
		(0.009)	(0.009)	(0.009)		(0.010)	(0.010)	(0.010)
Private*GO		-0.374***	-0.380***	-0.380***		-0.367***	-0.374***	-0.374***
		(0.109)	(0.106)	(0.106)		(0.096)	(0.092)	(0.092)
Labour*GO		1.010***	1.013***	1.013***		0.979***	0.982***	0.982***
		(0.158)	(0.155)	(0.155)		(0.168)	(0.165)	(0.165)
VA sector/province			0.001	0.001			0.005	0.005
			(0.012)	(0.012)			(0.013)	(0.013)
Sector labour/province			-0.393*	-0.393*			-0.418**	-0.418**
population			(0.215)	(0.215)			(0.193)	(0.193)
Average wage in province				0.027***				0.028***
by sector				(0.004)				(0.004)
Province-level income				-0.367***				-0.397***
per capita				(0.100)				(0.105)
Population density				-0.155***				-0.156***
				(0.057)				(0.057)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.648*	0.277	0.291	0.589	0.567	0.244	0.255	0.617
	(0.365)	(0.375)	(0.374)	(0.513)	(0.360)	(0.366)	(0.364)	(0.518)
Observations	34537	34537	34537	34537	34537	34537	34537	34537
R-squared	0.311	0.314	0.314	0.314	0.311	0.314	0.314	0.314
Adjusted R-squared	0.310	0.313	0.313	0.313	0.310	0.313	0.313	0.313
Differential in growth rates	0.136	0.087	0.087	0.087	0.141	0.081	0.080	0.080

Notes: FD refers to local (province-level) financial development. The variables Sales, Labour and Province-level income per capita are in natural logarithms. GO denotes GO50 for specifications (1)-(4) and GO100 for specifications (5)-(8). The differential in growth rates shows the difference in growth rates between firms in sector P (Education), at the 75th percentile of the growth opportunities GO50 (GO100) distribution, and firms in sector G (whole sales, retail trade and repair vehicles) or sector I (Accommodation and food service activities), at the 25th percentile of the growth opportunities GO50 (GO100) distribution, if these firms are located in Nam Dinh province instead of Thua Thien Hue, which are at the 75th and 25th percentiles of financial development distribution, respectively. The sample for estimation includes small firms with less than 20 employees. Robust standard errors, clustered at the province level, are given in parentheses. Significance at the 1%, 5% and 10% is indicated by ***, **, and *, respectively.

The results show that provincial financial development promotes the sales growth of small firms that are operating in sectors with strong growth opportunities. This finding is similar to the result in Fafchamps and Schündeln (2013) who investigate the effect of commune-level financial development on growth rates of value added of firms. The positive sign of the interaction term between provincial financial development and growth

opportunities confirms that the difference between growth in sectors with higher growth opportunities and growth in sectors with lower growth opportunities is larger in provinces with higher financial development than in provinces with lower financial development. For instance, as shown in the last row of Table 5.4, we compare the differences in growth rates between a firm in sector P at the 75th percentile of the GO50 distribution (which is the education sector with GO50 = 0.257) and a firm in sector G at the 25th percentile of GO50 distribution (which is the wholesale, retail trade and repair vehicles sector with GO50 = 0.064) when these firms are located in different localities (Nam Dinh instead of Thua Thien Hue). The difference in growth rates of sales is about 8.7% larger if these firms are located in Nam Dinh province, which is at the 75th percentile of the financial development distribution, instead of Thua Thien Hue, which is at the 25th percentile of the financial development distribution.[23] With regard to GO100, the difference in growth rates between firms in sector P and sector I (accommodation and food service activities) becomes 8.0% larger if they are located in Nam Dinh instead of Thua Thien Hue.

Adding more control variables, the effect of the interaction between financial development and growth opportunities on sales growth does not change. As a result, the differentials in sales growth rates are stable and positive at about 8%. Moreover, the effect of the initial value of sales (sales in 2009) is negative but insignificant when using GO50 and GO100, which is theoretically expected to control for the convergence effect, and is consistent with the findings in Fafchamps and Schündeln (2013). In addition, the interaction between financial development and the initial value of sales does not show significant impact on sales growth. In specifications (2) and (6), we include firm-level explanatory variables, interacting them with growth opportunities and province-level financial development. The results show that the more labour a firm employs, the faster its sales grow. Moreover, we find that government- or foreign-owned firms are better in taking advantage of financial development and growth opportunities.

To control for the impact of sector-specific characteristics, we include the share of value added of each sector to the total value added of the province and the share of labour

[23]We calculate growth differentials as β_1*(FD_2-FD_1)(GO_2 -GO_1), where FD_1 and FD_2 represent financial development in Thua Thien Hue and Nam Dinh province, and GO_1 and GO_2 denote growth opportunities of sectors at the 25th and 75th percentiles of the growth opportunities distribution.

in each sector to the total population of the province. The results in specifications (3), (4), (7) and (8) reveal that while former does not show a significant impact on sales growth, the latter has significantly negative impact on sales growth. To account for province-level development, we include the average wage rate in province by each sector, the province-level income per capita and population density. The results in specifications (4) and (8) show that average wage in province by sector has a positive effect on sales growth. This implies that in sectors with a higher average wage, firms would pay more for labour. Province-level income per capita exerts a significant and negative impact on sales growth. The result likely reflects that higher province-level income per capita attracts more firms to operate in the area and it increases the competition, which eventually results in lower sales growth per firm. Moreover, richer provinces could have better infrastructure that encourages new entrants and start-ups, which could further increase competition and reduce sales growth. Similarly, the negative impact of population density on sales growth could be attributed to higher competition among firms as more firms enter the market aiming at meeting the higher demand for goods and services in more densely populated provinces.

5.5.2 Investment growth

As an alternative measure of firm performance, we consider the effect of local financial development on the investment growth of small firms. Results in Table 5.5 show that provincial financial development promotes investment growth of firms irrespective of using GO50 or GO100 as proxies for growth opportunities. This result is similar to the findings by O'Toole and Newman (2017) although they do not control for growth opportunities and their measures of financial development are different from ours. Similar to results in Table 5.4, the differential in growth rates is positive. In particular, the difference between growth rates of firms in the education sector and firms in the whole sale, retail trade and repair vehicle sector (when using GO50) or firms in the accommodation and food service activities sector (when using GO100) is, respectively, 12.0% or 11.0% larger if firms in these sectors are located in Nam Dinh instead of Thua Thien Hue province.

Adding more control variables, we can see that the effects of the interaction term between local financial development and growth opportunities are qualitatively the same as in specifications (4) and (8) (with full control for local and sector development). Moreover, the interaction term between the initial value of investment and provincial financial development has a positive impact on investment growth. This shows that in provinces with higher financial development, firms with higher initial investment would have faster investment growth than firms with lower initial investment. However, the coefficient on the initial value of investment is not statistically significant.

Table 5.5: The effect of local financial development on investment growth

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	0.689***	0.493***	0.502***	0.502***	0.538***	0.346**	0.350*	0.350*
	(0.179)	(0.165)	(0.185)	(0.185)	(0.171)	(0.154)	(0.178)	(0.178)
Investment	0.016	0.011	0.010	0.010	0.015	0.009	0.008	0.008
	(0.026)	(0.025)	(0.024)	(0.024)	(0.026)	(0.025)	(0.024)	(0.024)
Investment*FD	0.150***	0.153***	0.152***	0.152***	0.150***	0.152***	0.152***	0.152***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Private*FD		-0.028***	-0.028***	-0.028***		-0.032***	-0.032***	-0.032***
		(0.007)	(0.007)	(0.007)		(0.007)	(0.007)	(0.007)
Private*GO		-0.442**	-0.451**	-0.451**		-0.472**	-0.483**	-0.483**
		(0.182)	(0.176)	(0.176)		(0.198)	(0.193)	(0.193)
Labour*GO		0.964***	0.974***	0.974***		0.937***	0.947***	0.947***
		(0.068)	(0.065)	(0.065)		(0.059)	(0.057)	(0.057)
VA sector/province			-0.005	-0.005			0.008	0.008
			(0.042)	(0.042)			(0.045)	(0.045)
Sector labour/province			-0.913**	-0.913**			-0.950**	-0.950**
population			(0.388)	(0.388)			(0.382)	(0.382)
Average wage in province				0.003				0.004**
by sector				(0.002)				(0.002)
Province-level income				-0.403***				-0.447***
per capita				(0.102)				(0.104)
Population density				-0.080**				-0.080**
				(0.030)				(0.032)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.187	-0.171	-0.133	1.161	0.081	-0.247	-0.210	1.177
	(0.547)	(0.548)	(0.550)	(0.705)	(0.547)	(0.549)	(0.550)	(0.718)
Observations	22769	22769	22769	22769	22769	22769	22769	22769
R-squared	0.174	0.177	0.177	0.177	0.174	0.177	0.177	0.177
Adjusted R-squared	0.172	0.174	0.175	0.175	0.172	0.174	0.174	0.174
Differential in growth rates	0.164	0.118	0.120	0.120	0.169	0.109	0.110	0.110

Notes: Investment is in natural logarithms. For further notes see Table 5.4.

Furthermore, the more labour a firm employs, the higher is its investment growth. We also find that firms owned by the government or foreigners are better in taking advantage of provincial financial development and growth opportunities than private firms. This

might be related to the fact that the majority of financial institutions are owned by the government, and hence could favour government owned firms over private firms. The result that foreign-owned firms tend to grow faster than private firms is consistent with the results in Beck et al. (2005).

Regarding the province and sector level characteristics, we do not find significant effects of the share of sector value added to total value added of the province on investment growth. However, firms in sectors with higher labour intensity and in sectors with higher average wages are more likely to have lower investment growth. This could reflect the associated cost of production which in turn reduces firms' profitability and financial resources available for investment. Similar to sales growth, investment growth is lower in provinces with higher provincial per capita income and population density.

5.5.3 Productivity growth

As an alternative measure of firm performance, we evaluate the productivity of labour, which is proxied by sales per worker and wage per sales. In the following, we examine the impact of provincial financial development on the productivity of labour for the period 2009–2013.

Sales per worker

Results on the effect of provincial financial development on the growth rate of sales per worker are documented in Table 5.6. The results reveal that the difference in growth rate of sales per worker between firms in sector P and firms in sector G (if using GO50) is about 6.8% larger if these firms are located in Nam Dinh province instead of Thua Thien Hue province. The corresponding growth differential is about 5.8% between firms in sector P and firms in sector I when we use GO100. These effects barely change when we control for firm, sector and provincial characteristics. This finding is similar to the results in Fafchamps and Schündeln (2013).

Wage per sales

Table 5.7 provides results on the determinants of the growth rate of wage per sales. The coefficient on the interaction between local financial development and growth

Table 5.6: The effect of local financial development on growth of sales per worker

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	0.435***	0.277**	0.287**	0.287**	0.316***	0.179*	0.184*	0.184*
	(0.121)	(0.120)	(0.126)	(0.126)	(0.096)	(0.096)	(0.100)	(0.100)
Salepw	-0.656**	-0.651**	-0.651***	-0.651***	-0.662***	-0.658***	-0.658***	-0.658***
	(0.243)	(0.240)	(0.240)	(0.240)	(0.242)	(0.240)	(0.239)	(0.239)
Salepw*FD	0.005	0.007	0.008	0.008	0.003	0.005	0.005	0.005
	(0.053)	(0.052)	(0.052)	(0.052)	(0.053)	(0.052)	(0.052)	(0.052)
Private*FD		-0.037***	-0.037***	-0.037***		-0.037***	-0.037***	-0.037***
		(0.011)	(0.010)	(0.010)		(0.010)	(0.010)	(0.010)
Private*GO		-0.278*	-0.282*	-0.282*		-0.227*	-0.232**	-0.232**
		(0.147)	(0.142)	(0.142)		(0.113)	(0.108)	(0.108)
Labour*GO		0.806***	0.809***	0.809***		0.766***	0.768***	0.768***
		(0.035)	(0.033)	(0.033)		(0.036)	(0.034)	(0.034)
VA sector/province			-0.006	-0.006			-0.003	-0.003
			(0.011)	(0.011)			(0.011)	(0.011)
Sector labour/province			-0.448*	-0.448*			-0.458*	-0.458*
population			(0.236)	(0.236)			(0.237)	(0.237)
Average wage in province				-0.002				0.001
by sector				(0.041)				(0.041)
Province-level income				-0.306				-0.385
per capita				(1.142)				(1.127)
Population density				-0.210				-0.188
				(0.513)				(0.508)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	8.089***	7.804***	7.832***	9.061***	8.019***	7.780***	7.803***	9.176***
	(1.142)	(1.125)	(1.131)	(2.835)	(1.148)	(1.130)	(1.136)	(2.824)
Observations	34537	34537	34537	34537	34537	34537	34537	34537
R-squared	0.409	0.411	0.411	0.411	0.409	0.411	0.411	0.411
Adjusted R-squared	0.408	0.410	0.410	0.410	0.408	0.410	0.410	0.410
Differential in growth rates	0.104	0.066	0.068	0.068	0.100	0.056	0.058	0.058

Notes: Salespw refers to Sales per worker, in natural logarithms. For further notes see Table 5.4.

opportunities is negative and statistically significant in all but one of the specifications. This shows that provincial financial development helps firms to reduce the cost of labour per unit of sales. The last row of Table 5.7 reports the difference in growth rates of wage per sales between firms in sectors at the 25th and 75th percentiles of the growth opportunities distribution when these firms operate in the same sectors but are located in provinces with higher financial development. The differential growth rate is -5.5% (using GO50) and -3.4% (using GO100), showing that operating in localities with higher financial development helps firms to reduce further labour cost per unit of sales.

Table 5.7: The effect of local financial development on growth of wage per sales

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	-0.353***	-0.212**	-0.229*	-0.229*	-0.217**	-0.096	-0.109	-0.109
	(0.095)	(0.104)	(0.114)	(0.114)	(0.084)	(0.090)	(0.095)	(0.095)
Wageps	-0.672***	-0.666***	-0.662***	-0.662***	-0.677***	-0.671***	-0.667***	-0.667***
	(0.238)	(0.234)	(0.234)	(0.234)	(0.238)	(0.235)	(0.234)	(0.234)
Wageps*FD	0.002	0.005	0.007	0.007	0.000	0.003	0.005	0.005
	(0.052)	(0.051)	(0.051)	(0.051)	(0.052)	(0.051)	(0.051)	(0.051)
Private*FD		0.042***	0.042***	0.042***		0.042***	0.042***	0.042***
		(0.013)	(0.013)	(0.013)		(0.012)	(0.012)	(0.012)
Private*GO		0.216	0.237	0.237		0.178	0.198*	0.198*
		(0.158)	(0.149)	(0.149)		(0.121)	(0.112)	(0.112)
Labour*GO		-0.751***	-0.760***	-0.760***		-0.711***	-0.720***	-0.720***
		(0.043)	(0.033)	(0.033)		(0.041)	(0.033)	(0.033)
VA sector/province			0.010	0.010			0.005	0.005
			(0.012)	(0.012)			(0.012)	(0.012)
Sector labour/province			1.685***	1.685***			1.691***	1.691***
population			(0.397)	(0.397)			(0.367)	(0.367)
Average wage in province				0.020				0.018
by sector				(0.025)				(0.025)
Province-level income				0.618				0.680
per capita				(0.817)				(0.809)
Population density				0.131				0.115
				(0.398)				(0.396)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6.416***	-6.131***	-6.208***	-9.132***	-6.346***	-6.104***	-6.176***	-9.217***
	(0.803)	(0.795)	(0.795)	(2.126)	(0.802)	(0.794)	(0.794)	(2.120)
Observations	34537	34537	34537	34537	34537	34537	34537	34537
R-squared	0.416	0.418	0.419	0.419	0.416	0.418	0.419	0.419
Adjusted R-squared	0.415	0.417	0.418	0.418	0.415	0.417	0.417	0.417
Differential in growth rates	-0.084	-0.051	-0.055	-0.055	-0.068	-0.030	-0.034	-0.034

Notes: Wageps represents Wage per sales, in natural logarithms. For further notes see Table 5.4.

5.5.4 Robustness checks: an alternative measure of local financial development

As a robustness check, we employ the number of financial suppliers per kilometre square at each province as an alternative measure of local financial development. As shown in Table 5.2, these financial development indicators are positively correlated with the baseline indicators (number of financial suppliers per 1000 people), with the correlation coefficient of 0.805. Robustness check results documented in Appendix 5.7 largely confirm our baseline results. In particular, the results show that provincial financial development enhances the performance of small firms in terms of increasing the growth rates of sales and investment. Local financial development also promotes productivity of labour as shown by its positive impact on the growth rate of sales per worker and its negative

effect on the growth rates of wage per sales.

5.6 Conclusions

In this paper we examined whether local financial development promotes the performance of small firms in Vietnam using an extensive firm-level survey from 2009 to 2013. Following Fisman and Love (2007) and Fafchamps and Schündeln (2013), we calculate growth opportunities in each sector based on the performance of large firms in order to address the potential endogeneity problem that financial suppliers extend more credit to sectors with better growth opportunities. We measure local financial development at the province level based on the number of financial suppliers per 1000 people in each province. Interacting local financial development with growth opportunities, we investigate the effects of local financial development on the performance of small firms, which is measured by means of the growth rates of sales, investment, sales per worker and wage per sales.

Our results show that at the province level, in sectors with growth opportunities, provincial financial development has a significantly positive impact on the growth rates of small firms in terms of sales, investment, and sales per worker while it has a significantly negative impact on the growth rates of wage per sales. Moreover, small firms tend to improve their performance better when they operate in sectors with stronger growth opportunities and in locations with higher level of financial development. Our results suggest that policy makers should promote local financial development so as to enhance firm performance.

5.7 Appendix for study 4

5.7.1 Sales growth

Table C.1: The effect of local financial development on sales growth

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	0.322***	0.220**	0.220**	0.220**	0.255***	0.160**	0.160**	0.160**
	(0.085)	(0.090)	(0.092)	(0.092)	(0.070)	(0.075)	(0.077)	(0.077)
Sales	-0.474***	-0.487***	-0.487***	-0.487***	-0.477***	-0.490***	-0.490***	-0.490***
	(0.156)	(0.155)	(0.155)	(0.155)	(0.156)	(0.155)	(0.155)	(0.155)
Sales*FD	0.040	0.040	0.040	0.040	0.039	0.039	0.039	0.039
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.031)	(0.031)	(0.031)
Private*FD		-0.030**	-0.031**	-0.031**		-0.032**	-0.033**	-0.033**
		(0.012)	(0.012)	(0.012)		(0.013)	(0.013)	(0.013)
Private*GO		-0.341**	-0.347**	-0.347**		-0.339***	-0.346***	-0.346***
		(0.133)	(0.130)	(0.130)		(0.117)	(0.114)	(0.114)
Labour*GO		0.986***	0.989***	0.989***		0.958***	0.961***	0.961***
		(0.154)	(0.151)	(0.151)		(0.165)	(0.161)	(0.161)
VA sector/province			0.003	0.003			0.006	0.006
			(0.012)	(0.012)			(0.012)	(0.012)
Sector labour/province			-0.468**	-0.468**			-0.485**	-0.485**
population			(0.222)	(0.222)			(0.197)	(0.197)
Average wage in province				0.027***				0.028***
by sector				(0.003)				(0.004)
Province-level income				-0.411***				-0.435***
per capita				(0.121)				(0.126)
Population density				-0.129***				-0.128***
				(0.046)				(0.045)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	0.484	0.162	0.178	0.590	0.438	0.154	0.169	0.638
	(0.343)	(0.344)	(0.343)	(0.535)	(0.343)	(0.343)	(0.341)	(0.544)
Observations	34537	34537	34537	34537	34537	34537	34537	34537
R-squared	0.313	0.316	0.316	0.316	0.312	0.316	0.316	0.316
Adjusted R-squared	0.311	0.314	0.314	0.314	0.311	0.314	0.314	0.314
Differential in growth rates	0.212	0.145	0.145	0.145	0.222	0.139	0.139	0.139

Notes: FD is the number of financial suppliers per kilometre square at the province level and measured in natural logarithms. For further notes see Table 4.

5.7.2 Investment growth

Table C.2: The effect of local financial development on investment growth

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	0.393***	0.305***	0.317***	0.317***	0.286***	0.200**	0.211**	0.211**
	(0.097)	(0.092)	(0.098)	(0.098)	(0.083)	(0.076)	(0.082)	(0.082)
Investment	-0.106***	-0.111***	-0.112***	-0.112***	-0.108***	-0.113***	-0.115***	-0.115***
	(0.024)	(0.024)	(0.023)	(0.023)	(0.024)	(0.024)	(0.023)	(0.023)
Investment*FD	0.127***	0.129***	0.129***	0.129***	0.126***	0.128***	0.128***	0.128***
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Private*FD		-0.050***	-0.050***	-0.050***		-0.054***	-0.054***	-0.054***
		(0.010)	(0.010)	(0.010)		(0.011)	(0.011)	(0.011)
Private*GO		-0.532***	-0.545***	-0.545***		-0.581***	-0.596***	-0.596***
		(0.165)	(0.158)	(0.158)		(0.196)	(0.190)	(0.190)
Labour*GO		0.686***	0.707***	0.707***		0.685***	0.705***	0.705***
		(0.072)	(0.068)	(0.068)		(0.067)	(0.066)	(0.066)
VA sector/province			-0.007	-0.007			0.004	0.004
			(0.036)	(0.036)			(0.040)	(0.040)
Sector labour/province			-1.807***	-1.807***			-1.818***	-1.818***
population			(0.449)	(0.449)			(0.430)	(0.430)
Average wage in province				0.004				0.005
by sector				(0.004)				(0.004)
Province-level income				-0.752***				-0.792***
per capita				(0.204)				(0.214)
Population density				0.043				0.054*
				(0.027)				(0.027)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-0.550	-0.827	-0.752	1.612	-0.619	-0.886*	-0.812	1.647
	(0.533)	(0.524)	(0.528)	(0.975)	(0.532)	(0.525)	(0.529)	(0.997)
Observations	22769	22769	22769	22769	22769	22769	22769	22769
R-squared	0.154	0.155	0.156	0.156	0.153	0.155	0.156	0.156
Adjusted R-squared	0.151	0.153	0.154	0.154	0.151	0.153	0.153	0.153
Differential in growth rates	0.259	0.201	0.209	0.209	0.249	0.174	0.184	0.184

Notes: FD is the number of financial suppliers per kilometre square at the province level and measured in natural logarithms. For further notes see Table 5.

5.7.3 Productivity growth

Table C.3: The effect of local financial development on growth of sales per worker

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	0.238***	0.161**	0.164**	0.164**	0.173***	0.106*	0.109*	0.109*
	(0.061)	(0.066)	(0.068)	(0.068)	(0.050)	(0.053)	(0.055)	(0.055)
Salepw	-0.649***	-0.647***	-0.647***	-0.647***	-0.652***	-0.650***	-0.650***	-0.650***
	(0.144)	(0.142)	(0.142)	(0.142)	(0.144)	(0.143)	(0.142)	(0.142)
Salepw*FD	0.009	0.012	0.012	0.012	0.008	0.010	0.011	0.011
	(0.028)	(0.028)	(0.028)	(0.028)	(0.028)	(0.027)	(0.027)	(0.027)
Private*FD		-0.046***	-0.046***	-0.046***		-0.046***	-0.046***	-0.046***
		(0.012)	(0.011)	(0.011)		(0.011)	(0.011)	(0.011)
Private*GO		-0.257*	-0.262**	-0.262**		-0.216**	-0.222**	-0.222**
		(0.127)	(0.122)	(0.122)		(0.099)	(0.094)	(0.094)
Labour*GO		0.799***	0.801***	0.801***		0.760***	0.762***	0.762***
		(0.034)	(0.032)	(0.032)		(0.036)	(0.034)	(0.034)
VA sector/province			-0.003	-0.003			-0.000	-0.000
			(0.011)	(0.011)			(0.011)	(0.011)
Sector labour/province			-0.506*	-0.506*			-0.508*	-0.508*
population			(0.254)	(0.254)			(0.251)	(0.251)
Average wage in province				-0.004				-0.002
by sector				(0.020)				(0.020)
Province-level income				-0.237				-0.286
per capita				(0.573)				(0.563)
Population density				-0.362				-0.332
				(0.624)				(0.618)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	7.986***	7.736***	7.762***	8.950***	7.946***	7.734***	7.757***	9.033***
	(1.122)	(1.100)	(1.107)	(1.768)	(1.127)	(1.105)	(1.112)	(1.764)
Observations	34537	34537	34537	34537	34537	34537	34537	34537
R-squared	0.409	0.412	0.412	0.412	0.409	0.412	0.412	0.412
Adjusted R-squared	0.408	0.411	0.411	0.411	0.408	0.411	0.411	0.411
Differential in growth rates	0.157	0.106	0.108	0.108	0.151	0.092	0.095	0.095

Notes: FD is the number of financial suppliers per kilometre square at the province level and measured in natural logarithms. For further notes see Table 6.

Table C.4: The effect of local financial development on growth of wage per sales

	GO50				GO100			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
FD*GO	-0.181***	-0.111**	-0.121*	-0.121*	-0.109**	-0.049	-0.058	-0.058
	(0.050)	(0.055)	(0.061)	(0.061)	(0.045)	(0.047)	(0.051)	(0.051)
Wageps	-0.662***	-0.659***	-0.657***	-0.657***	-0.664***	-0.661***	-0.659***	-0.659***
	(0.140)	(0.139)	(0.138)	(0.138)	(0.141)	(0.139)	(0.139)	(0.139)
Wageps*FD	0.007	0.010	0.011	0.011	0.006	0.009	0.010	0.010
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.026)	(0.026)	(0.026)
Private*FD		0.053***	0.054***	0.054***		0.054***	0.054***	0.054***
		(0.013)	(0.013)	(0.013)		(0.013)	(0.013)	(0.013)
Private*GO		0.210	0.231*	0.231*		0.181*	0.201**	0.201**
		(0.134)	(0.126)	(0.126)		(0.103)	(0.095)	(0.095)
Labour*GO		-0.748***	-0.757***	-0.757***		-0.709***	-0.717***	-0.717***
		(0.045)	(0.034)	(0.034)		(0.043)	(0.034)	(0.034)
VA sector/province			0.006	0.006			0.003	0.003
			(0.011)	(0.011)			(0.012)	(0.012)
Sector labour/province			1.748***	1.748***			1.743***	1.743***
population			(0.405)	(0.405)			(0.371)	(0.371)
Average wage in province				0.021**				0.020*
by sector				(0.010)				(0.010)
Province-level income				0.568				0.608
per capita				(0.394)				(0.388)
Population density				0.217				0.196
				(0.467)				(0.464)
Sector dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Province dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-6.329***	-6.072***	-6.146***	-9.027***	-6.293***	-6.071***	-6.142***	-9.101***
	(0.789)	(0.777)	(0.778)	(1.396)	(0.789)	(0.779)	(0.780)	(1.394)
Observations	34537	34537	34537	34537	34537	34537	34537	34537
R-squared	0.416	0.419	0.419	0.419	0.416	0.418	0.419	0.419
Adjusted R-squared	0.415	0.418	0.418	0.418	0.415	0.417	0.418	0.418
Differential in growth rates	-0.119	-0.073	-0.080	-0.080	-0.095	-0.043	-0.050	-0.050

Notes: FD is the number of financial suppliers per kilometre square at the province level and measured in natural logarithms. For further notes see Table 7.

6 Concluding remarks

This thesis contributes to the literature on the finance-growth nexus, especially the effect of local financial development on economic growth in developing countries. This accumulates four self-contained studies which analyse the relationship between local financial development and economic growth in Vietnam by considering local economic growth at different levels. While the first study focuses on household welfare by using annual consumption, income and consumption smoothing, the other three studies consider firm growth including sales, investment and firm productivity (e.g., return on assets, return on equity, sales per worker and wage per sales). In the first study, we measure local financial development at three distinct levels including district, sub-district and village. In the other three studies, we consider the development of local finance at the province level. In order to address the endogeneity in analyse the local finance-growth nexus, we apply the identification through heteroscedasticy in first three studies and using the growth opportunities to account for this problem in the fourth study. Our studies contribute to the empirical research as follows.

In the first contribution, we analyse how local financial development (at district, sub-district and village level) affect household welfare. Using a household level survey in Thailand - Vietnam Social Economics Panel from 2007 to 2013, our results document that local financial development promotes household welfare in terms of annual income and consumption. Moreover, households with demand for credit consume more in financially more developed localities and local financial development significantly reduces the probability of cutting consumption by negative income shocks. This reflects the role of local financial development in consumption smoothing. Therefore, policy makers should consider enhancing access to finance at the local level as an important policy option for promoting household welfare in rural Vietnam.

In the second contribution, we further examine the effects of province-level financial development, corruption and the joint impact of these factors on the performance of Vietnamese firms in terms of the growth rates of sales, investment and sales per worker. Using a nationally representative panel survey that covers over 40,000 firms

for the period 2009-2013, we find that province-level financial development promotes firm growth while corruption hinders it. Moreover, financial development and corruption control are complementary to each other in their effects on firm growth. This implies that policy makers could promote firm growth by improving financial development or reducing corruption at the province level. Furthermore, the marginal effect of financial development is stronger when the level of corruption is low, and vice versa. This suggests that controlling the corruption at the province level would bring benefits to the growth of firms.

In the third study, we contribute to literature by providing evidence on the effect of local financial development on the gender gap in promoting firm growth. We investigate the effect of provincial financial development and entrepreneurs' gender on firm growth in Vietnam. Using the same data set and method of identification as in the second study, our results show that local financial development promotes firm growth. The results also reveal the gender gap that male-owned firms perform better in terms of improving the growth rates of sales, investment, ROA and ROE. However, the joint effect of local financial development and male ownership is significantly negative through all specifications. This suggests that by improving local financial development at the province level, policy makers could help female-owned firms reduce their constraints in promoting firm growth.

The fourth study contributes to the literature by re-examining the relationship between local financial development and firm growth based on an identification strategy that uses growth opportunities. We find that local financial development promotes the growth rates of sales, investment and sales per worker while reducing the growth rate of wage per sales of small firms. This implies that firms grow faster in a financially developed province if they operate in sectors with growth opportunities. Moreover, locating in localities with higher financial development, the difference in growth rates of firms operating in sectors with stronger growth opportunities and firms in sectors with lower growth opportunities is larger.

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Declaration for admission to the doctoral examination (according to §16 PSTO)

I confirm,

1. that the dissertation that I submitted

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3. that in the process of completing this doctoral thesis, no intermediaries were compensated to assist me neither with the admissions or preparation processes, and in this process,

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