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The impact of local financial development on firm growth in Vietnam: Does the level of corruption matter?

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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 for the period 2009–2013 and applying a heteroskedasticity-based identification strategy, we find that province-level financial development promotes firm growth, while corruption hinders it. Most importantly, the marginal effect of financial development on firm growth depends negatively on the level of corruption. Moreover, financial development exacerbates the growth-retarding effect of corruption.

1. Introduction

The past three decades have witnessed extensive empirical research on the relationship between financial development and economic growth.[1] There is also a large body of literature investigating the macroeconomic impacts of corruption.[2] What has received less attention is the interaction between financial development and corruption in their effects on economic development. There are several reasons to expect such an interaction effect. On the one hand, studies have shown that weak property rights discourage entrepreneurs from reinvesting their profits, even when they own the collateral required to obtain external finance (e.g., Johnson et al., 2002). Hence, to the extent that corruption weakens the enforcement of property rights (Acemoglu and Verdier, 1998),

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[1] Most studies document that financial development fosters economic growth (e.g., King and Levine, 1993; Rajan and Zingales, 1998; 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). For more details on the finance-growth debate, see Levine (2005) and Panizza (2014).

[2] The results from the corruption-growth literature are generally mixed. Some studies, such as Shleifer and Vishny (1993), Mauro (1995), Rand and Tarp (2012), and Gründler and Potrafke (2019), document that corruption impedes economic development likely because it weakens central governments and creates economic distortions. However, there are also studies which show that corruption may foster growth by alleviating the distortions of inefficient governance institutions (e.g., Leff, 1964; Leys, 1965; Huntington, 1968; and Wang and You, 2012).

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it is plausible to expect that corruption dilutes the growth-promoting effects of financial development. Moreover, corruption in the financial system may redirect credit to unproductive or even wasteful projects (Ghirmay, 2004; Arcand et al., 2015), thereby attenuating the positive impact of financial development on economic growth. On the other hand, a potentially positive interaction between financial development and corruption in their effects on economic growth has been suggested by Ahlin and Pang (2008). Modelling corruption as the size of the bribe that firms have to pay, and assuming that the bribe should be paid in advance (or the timing of the bribe payments is unknown), Ahlin and Pang (2008) show that corruption raises the firm's need for liquidity. As a result, financial development could exert a stronger impact when the level of corruption is high and corruption becomes more detrimental to firm growth in a less developed financial system. For these reasons, the net effect of the interaction between financial development and corruption remains to be an empirical question.

The only study that we are aware of that provides firm-level evidence on the joint effects of corruption and financial development on economic development is that of Wang and You (2012). Using data on Chinese firms, Wang and You (2012) document that both corruption and financial development enhance the growth of firms. Moreover, they find that financial development and corruption are substitutes in their growth-promoting effects, i.e., the marginal effect of financial development is high when the level of corruption is low, and vice versa. These results are in contrast to the cross-country evidence documented in Ahlin and Pang (2008). Wang and You (2012) also underscore that the observed positive effect of corruption on firm growth is not consistent with worldwide evidence. It is rather a typical character of the "East Asian paradox" where rapid economic growth is recorded in the midst of flourishing corruption cultures. Therefore, it remains unclear if the results in Wang and You (2012) on the joint effects of finance and corruption on firm growth are specific to Chinese firms, or if they represent a worldwide phenomenon. In particular, are financial development and corruption substitutes in their effects on firm growth even in countries where corruption is detrimental to firm growth? In this paper, we aim to fill this gap in the literature by examining the joint effects of financial development and corruption on firm growth in Vietnam—a country for which studies have consistently documented the negative repercussions of corruption on firm growth (e.g., Tromme, 2016).

Three main reasons make Vietnam an interesting country for conducting such a micro-level study. First, as an emerging economy, Vietnam 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 percent of GDP at the end of 2011 (World Bank, 2014).[3] 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 indicates that petty corruption has become less frequent but macro corruption has worsened.[4] 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 on firm growth.

We employ a large firm-level panel dataset from the Vietnam Enterprise Survey covering more than 40,000 firms from 2009 to 2013. Our main empirical strategy to identify the causal impacts of financial development and corruption on firm growth is the heteroskedasticity-based identification of Lewbel (2012). We find that province-level financial development has significantly positive effects on firm growth in terms of the growth rates of sales, investment and sales per worker. On the contrary, corruption affects firm growth negatively. Most notably, financial development and corruption interact negatively in affecting firm growth: While corruption weakens the growth-promoting effect of financial development, financial development exacerbates the growth-retarding effect of corruption. Our results on the substitution relationship[5] between financial development and corruption on firm growth corroborate the firm-level evidence in Wang and You (2012) despite the fact that our results are obtained for a country where corruption impedes firm growth.

In Section 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, and outline the estimation methodology in Section 4. In Section 5, we discuss the empirical results and provide robustness checks. Section 6

[3] 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 privatization 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).

[4] 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.

[5] In this paper, we use the phrase "substitution relationship" to refer to a negative interaction effect. It is noteworthy, however, that the two factors may not be substitutes in the strict sense of the word if one of the factors, as in our case, has a negative effect on firm growth.

concludes. Further discussions on the heteroskedasticity-based identification strategy are presented in Appendix A and robustness results are provided in Appendices B and C.

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 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.

2.1. The finance-growth nexus

The literature on the finance-growth relationship dates back at least to Schumpeter (1911), who emphasized that obtaining 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; 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 relationship. 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, 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, favouring entry of new firms and reducing the rate of exit of old firms in Italy. Focusing on institutional quality differences among Italian regions, Moretti (2014) documents that a sufficiently developed institutional environment strengthens the positive effects of greater financial depth on firm productivity 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 at the district-, sub-district- and village–levels on households' annual income, consumption and consumption smoothing.

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 that arise from inefficient institutions.

Among the "sanders", Shleifer and Vishny (1993) illustrate 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. A recent cross-country study by Gründler and Potrafke (2019) also confirms that corruption significantly hinders economic growth. At the micro level, Kaufmann and Wei (1999) use three worldwide firm-level surveys and document 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 aforementioned 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 have reduced firm growth in Uganda, with the effect being three times higher than that of taxation. 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 argue 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 government 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. Méon and Weill (2010) report that the effects of corruption on efficiency depend on the 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.

A recent paper by Hanousek and Kochanova (2016) aims to reconcile the mixed results on the effects of corruption on firm growth found in previous studies. In particular, the authors distinguish between the means and dispersions of individual firm bribes in a given "local bribery environment". According to their results, a higher mean level of bribery generally hinders firm growth, whereas a higher dispersion of individual firm bribes promotes it.

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 the following, we discuss two potential channels through which financial development and corruption could interact in affecting economic growth: The property rights channel and the liquidity channel.

The property rights channel: In an empirical study of firms from post-communist economies, Johnson et al. (2002) document that weak property rights discourage entrepreneurs from undertaking new investments, even when external finance is available. Given that corruption is known to weaken the enforcement of property rights (Acemoglu and Verdier, 1998), it is plausible to expect that corruption attenuates the growth-promoting effects of financial development. This suggests a negative interaction effect between financial development and corruption. Corruption could also weaken the finance-growth link if it interferes in the efficient functioning of credit suppliers. Corruption in the banking sector may redirect credit to unproductive or even wasteful projects (Ghirmay, 2004; Arcand et al., 2015), thereby attenuating the positive impact of financial development on economic growth.

The liquidity channel: Noting that bribes have often to be paid upfront, Ahlin and Pang (2008) underscore that corruption exhausts firms' internal financial resources and raises their need for external finance. Corruption would still increase the financing needs of firms even if bribes have to be paid during the implementation of the project. Paying the bribes after project completion would also not lower the financing need as long as the timing of the bribe is uncertain. As a result, financial development is more potent when the level of corruption is high, while corruption is more detrimental when the financial system is less developed. Hence, Ahlin and Pang (2008) conjecture that financial development and corruption are complementary (interact positively) in their effects on economic growth.

To empirically test the hypotheses of complementarity or substitutability between financial development and corruption, Ahlin and Pang (2008) introduce the interaction between financial development and corruption into a standard growth model. In support of the liquidity channel, they find a significantly positive interaction effect. This implies that while financial development and corruption have a positive and negative effect on economic growth, respectively, these two factors act as complements in affecting economic growth. Results from industry-level regressions also corroborate the cross-country results in confirming the liquidity channel.

While examining 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 significantly positive. This evidence is also confirmed by Arcand et al. (2015) and supports the property rights channel.

Examining Ahlin and Pang's (2008) hypothesis at the micro level, Wang and You (2012) document that a high level of corruption promotes the growth of Chinese firms, and that the marginal effect of financial development is a negative function of corruption, and vice versa. These results on the substitution relationship between the effects of financial development and corruption are in sharp contrast to the cross-country results documented in Ahlin and Pang (2008). However, given the fact that growth-promoting corruption is a typical "East Asian paradox", it remains unclear if the results in Wang and You (2012) are specific to Chinese firms, or if they represent the firm-level corruption-growth relationship in emerging economies or even worldwide. In other words, the relationship between financial development and corruption could be different in countries where corruption is known to have detrimental effects on firm growth.

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 a negative interaction effect between financial development and corruption in reducing income inequality. Namely, promoting financial development has a bigger impact in reducing income

inequality if it is supported by policies that contain corruption levels. 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.

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 more likely to be affected by financial constraints and corruption than large firms, 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): The marginal effect of financial development on firm growth is a negative function of corruption, and the marginal effect of corruption is also a negative function of financial development. In other words, financial development and corruption interact negatively in their effects on firm growth. Hence, assuming that the property rights channel is stronger than the liquidity channel, we conjecture that the impact of financial development on firm growth is likely to be smaller in provinces with a higher level of corruption. Moreover, we expect increasing financial development to exacerbate the detrimental effects of corruption on firm growth.

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 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, the growth rate of sales per worker is at 17.9% annually, while investment and sales grow at rates of 19.8% and 16.4%, respectively.[6] To minimize risks of endogeneity, all of our explanatory variables are lagged by one period, and hence are measured for the years 2009–2012. Moreover, to mitigate potential effects of outliers on our results, we exclude observations where the dependent variables (growth rates of sales per worker, investment and sales) are smaller than the 1 percentile and larger than the 99 percentile of their respective distributions. Annually, firms have average sales per worker of more than 1 billion Vietnamese dong (VND); a representative firm invests about 7.4 billion VND and receives sales revenue of about 7.9 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 11.6 billion VND. About 33.4% of the firms are privately owned, and hence are not even partially owned by foreigners or the government.

Panel B of Table 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 100,000 people 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 1000 people 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 29.3 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 and 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

[6] It is noteworthy that the data are not deflated. Hence, with 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 7.3%, 9.3% and 5.8%, 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.

Table 1
Summary statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
Panel A: Firm-level characteristics					
Growth of sales per worker	140,842	0.179	1.160	−3.767	5.208
Investment growth	137,745	0.198	1.193	−4.354	5.337
Sales growth	140,841	0.164	1.125	−3.887	5.305
Sales per worker[(a)]	140,842	1.060	3.662	0.000	263.502
Investment[(a)]	137,745	7.353	24.930	0.000	906.078
Sales[(a)]	140,841	7.912	26.281	0.000	906.078
Labour	140,842	8.351	8.012	1.000	335.000
Asset[(a)]	140,841	11.634	43.124	0.000	4121.473
Private	140,842	0.334	0.472	0.000	1.000
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 2010–2013. 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.

sector have paid for informal costs. On average, 54.9% of enterprises confirm this statement, 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%, respectively.

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 1, more than 56.2% 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 has combined the above four indicators and constructed the so-called low informal charges index.[7] The low informal charges index is given on a scale from 1 to 10, with 1 and 10 representing the least and most favorable business environments, respectively. However, as our interest lies in the level of corruption, and not the business environment, we take the mean of the first three sub-indices (*Sub*1, *Sub*2 and *Sub*3) to construct our indicator for the level of corruption at the province level. The sub-index *Sub*4 is excluded due to its low correlations with other indices as shown in Table 2. The resulting indicator (*IC*) ranges from 0 to 1, with higher values representing higher levels of corruption (higher percentage of paying for informal charges) at the province level.

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:

$$\Delta Y_{fi,t} = \alpha_0 + \alpha_1 FD_{i,t-1} + \alpha_2 Corruption_{i,t-1} + \alpha_3 FD_{i,t-1} * Corruption_{i,t-1} + \\ + \alpha_4 Y_{fi,t-1} + X_{fi,t-1}\boldsymbol{\beta} + \epsilon_{fi,t}, \quad (1)$$

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

Table 2
Correlation of corruption indices.

	IC	*Sub1*	*Sub2*	*Sub3*	*Sub4*
IC	1				
Sub1	0.840*	1			
Sub2	0.725*	0.321*	1		
Sub3	0.887*	0.792*	0.398*	1	
Sub4	0.201*	0.242*	0.095	0.169	1

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

where $\Delta Y_{fi,t}$ represents a measure of growth (growth of sales per worker, investment and sales) of firm *f* located in 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. The lagged level of the dependent variable ($Y_{fi,t-1}$) is included to account for effects of initial conditions, i.e., firm size (see, e.g., Evans, 1987; Fisman and Svensson, 2007; Hall, 1987; Wang and You, 2012). 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 has been 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 are substitutes in their effects on firm growth (H_3: α_3 is negative) such that financial development shows stronger effects on firm growth in provinces with lower level of corruption. In some of the specifications, we will also include the square of local financial development to account for the possibility that the interaction effect may be due to some kind of non-linearity in the effects of financial development (e.g., Arcand et al., 2015).

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.

To address any potential endogeneity problem in estimating the model in (1), we employ the heteroskedasticity-based identification method proposed by Lewbel (2012), which builds upon an earlier work of Rigobon (2003). This approach allows identification by means of internal instruments without imposing any exclusion restrictions. In the following, we provide a brief intuitive explanation of this approach while deferring the more formal description of this procedure to Appendix A.[8] Let Y_1, Y_2 and X denote the dependent variable, the endogenous variables and the exogenous variables, respectively. To build the instruments, we first regress each endogenous variable in Y_2 on the exogenous variables X and retrieve the vector of residuals $\hat{V}$. Subsequently, the instruments are obtained as $(X-\overline{X})\hat{V}$, where $\overline{X}$ is the mean of X. An important requirement for the validity of these instruments is that the residuals $\hat{V}$ are heteroskedastic. In light of the difficulty in finding valid external instruments in empirical research, it is not surprising that a rapidly growing number of studies have applied this identification strategy to deal with endogeneity problems (see, e.g., Gründler and Potrafke, 2019; Mallick, 2012; Tran et al., 2018).

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 the transformed data.[9] Controlling for firm fixed effects is important to minimize the potential endogeneity of local financial development, corruption and firm growth (Hanousek and Kochanova, 2016).

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 diagnostics, which highlight the suitability of our model and estimation strategy to test the three hypotheses that financial development promotes firm growth (H_1), corruption hinders firm growth (H_2), and financial development and corruption interact negatively in affecting firm growth (H_3). Subsequently, we discuss empirical results regarding the 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. Throughout, the discussion of empirical results refers to the 5% nominal significance level.

5.1. Model diagnostics

Tables 3–5 document our baseline results obtained from estimating equation (1) using the number of financial suppliers per 1000 people as a measure of local financial development and informal charges (*IC*) as an indicator of corruption. The heteroskedasticity-

[8] Detailed discussions of the approach can be found in Lewbel (2012) and Baum and Schaffer (2012).

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

Table 3
The effects on growth rate of sales per worker.

	Endogeneity treatment			
	FD	FD and IC	FD, IC and FD*IC	FD, IC, FD*IC and FD^2
	(1)	(2)	(3)	(4)
FD	0.136**	0.217***	0.515***	0.479***
	(0.053)	(0.033)	(0.064)	(0.078)
Informal charges (IC)	−0.158***	0.148**	−0.950***	−1.076***
	(0.046)	(0.067)	(0.191)	(0.191)
FD∗IC			−0.460***	−0.474***
			(0.081)	(0.072)
Initial	−0.939***	−0.941***	−0.937***	−0.936***
	(0.004)	(0.002)	(0.002)	(0.001)
Labor	0.102***	0.101***	0.099***	0.099***
	(0.004)	(0.004)	(0.003)	(0.002)
Asset	0.003	−0.001	0.001	0.001
	(0.002)	(0.002)	(0.001)	(0.001)
Private	−0.054**	−0.044*	−0.075***	−0.058***
	(0.025)	(0.023)	(0.018)	(0.015)
Provincial per capita income	0.002***	0.003***	0.002***	0.002***
	(0.001)	(0.001)	(0.000)	(0.001)
FD^2				−0.007**
				(0.003)
Year dummies	Yes	Yes	Yes	Yes
Constant	0.002***	0.003***	0.001**	0.001***
	(0.001)	(0.001)	(0.001)	(0.000)
Observations	133,390	133,390	133,390	133,390
R-squared	0.533	0.532	0.531	0.531
Overidentification	0.043	0.113	0.124	0.199
Weak identification	21.671	16.831	22.420	50.421
Marginal effects of FD				
Corruption at 25th			0.290***	0.288***
			0.029	0.031
Corruption at 50th, 75th			0.183***	0.178***
			0.019	0.019
Corruption at 90th			0.176***	0.170***
			0.019	0.019
Changing from 90th to 25th			0.115	0.118
Marginal effects of Corruption				
FD at 25th			−0.976***	−1.103***
			0.195	0.195
FD at 50th			−0.980***	−1.107***
			0.196	0.196
FD at 75th			−1.003***	−1.131***
			0.200	0.199
Changing from 75th to 25th			0.027	0.028

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 50th and 75th percentiles of corruption are the same. 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. *FD* and FD^2 denote, respectively, the level and the square of local financial development, which is measured by the number of financial suppliers per 1000 people. 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.

based identification relies on the assumption that there exist correlations between the exogenous variables of the model and variances of residuals obtained from regressing endogenous variables on the exogenous 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 heteroskedasticity-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 the overidentification and the weak identification tests support most of the specifications and, hence, the heteroskedasticity-based identification strategy.

With respect to the control variables, results show significantly 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 sales per worker, sales and investment are consistent with the literature which documents that smaller firms grow faster than large firms (e.g., Evans, 1987; Fisman and Svensson, 2007; Hall, 1987; Wang and You, 2012). 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.

Table 4
The effects on growth rate of sales.

	Endogeneity treatment			
	FD	FD and IC	FD, IC and FD*IC	FD, IC, FD*IC and FD^2
	(1)	(2)	(3)	(4)
FD	−0.052	0.053	0.164**	0.012
	(0.054)	(0.035)	(0.064)	(0.056)
Informal charges (IC)	−0.017	0.018	−0.489**	−0.281*
	(0.048)	(0.068)	(0.201)	(0.152)
FD∗IC			−0.226***	−0.160***
			(0.078)	(0.057)
Initial	−0.888***	−0.894***	−0.891***	−0.891***
	(0.004)	(0.002)	(0.001)	(0.001)
Labor	0.081***	0.087***	0.084***	0.084***
	(0.003)	(0.003)	(0.001)	(0.001)
Asset	0.008***	0.002	0.003***	0.002***
	(0.003)	(0.001)	(0.001)	(0.001)
Private	−0.033	−0.009	−0.022	−0.012
	(0.023)	(0.022)	(0.021)	(0.017)
Provincial per capita income	−0.002***	−0.002***	−0.002***	−0.001**
	(0.001)	(0.001)	(0.001)	(0.000)
FD^2				−0.017***
				(0.002)
Year dummies	Yes	Yes	Yes	Yes
Constant	−0.000	0.001**	0.001*	0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	133,382	133,382	133,382	133,382
R-squared	0.509	0.509	0.508	0.509
Overidentification	0.436	0.264	0.360	0.437
Weak identification	21.226	17.083	19.181	44.267
Marginal effects of FD				
Corruption at 25th			0.053*	0.029
			0.029	0.023
Corruption at 50th, 75th			0.000	−0.008
			0.016	0.014
Corruption at 90th			−0.003	−0.010
			0.016	0.014
Changing from 90th to 25th			0.056	0.040
Marginal effects of Corruption				
FD at 25th			−0.501**	−0.290*
			0.206	0.155
FD at 50th			−0.503**	−0.291*
			0.206	0.156
FD at 75th			−0.515**	−0.299*
			0.210	0.158
Changing from 75th to 25th			0.013	0.009

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.

Provincial per capita income has a significantly positive impact on the growth rate of sales per worker, a significantly negative impact on the growth rate of sales and a positive but largely insignificant impact on investment. 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.

5.2. Effects of local financial development and corruption on firm growth

Table 3 documents the estimated effects of province-level financial development, corruption and their interaction on the growth rate of sales per worker. Results in specifications (1) and (2) are obtained without controlling for the interaction effect of financial development and corruption. Specification (3) incorporates the interaction effect, while specification (4) additionally takes into account the potential non-linearity in the effects of financial development on firm growth. While all specifications report results obtained by using the heteroskedasticity-based IV estimation, they differ in the variable which is assumed to be endogenous: financial development in (1); financial development and corruption in (2); financial development, corruption and the interaction term in (3); and financial development, its interaction with corruption, corruption and the square of financial development in (4).

Table 5
The effects on growth rate of investment.

	Endogeneity treatment			
	FD	FD and IC	FD, IC and FD*IC	FD, IC, FD*IC and FD^2
	(1)	(2)	(3)	(4)
FD	−0.108*	0.042	0.225***	0.071
	(0.058)	(0.026)	(0.064)	(0.053)
Informal charges (IC)	−0.036	0.096	−0.565**	−0.497***
	(0.063)	(0.075)	(0.224)	(0.161)
FD∗IC			−0.298***	−0.263***
			(0.084)	(0.061)
Initial	−0.899***	−0.902***	−0.900***	−0.900***
	(0.004)	(0.002)	(0.001)	(0.001)
Labor	0.100***	0.107***	0.106***	0.106***
	(0.005)	(0.003)	(0.002)	(0.001)
Asset	0.008***	0.002	0.002	0.001
	(0.003)	(0.002)	(0.001)	(0.001)
Private	0.023	0.036*	0.025	0.014
	(0.024)	(0.021)	(0.017)	(0.015)
Provincial per capita income	0.000	0.001	−0.000	0.001*
	(0.001)	(0.001)	(0.001)	(0.000)
FD^2				−0.021***
				(0.001)
Year dummies	Yes	Yes	Yes	Yes
Constant	−0.002	0.001	−0.000	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	130,193	130,193	130,193	130,193
R-squared	0.497	0.497	0.497	0.497
Overidentification	0.113	0.096	0.202	0.362
Weak identification	23.550	14.853	21.934	45.258
Marginal effect and standard errors				
Corruption at 25th			0.080***	0.059***
			0.026	0.019
Corruption at 50th, 75th			0.010	−0.003
			0.014	0.010
Corruption at 90th			0.006	−0.006
			0.014	0.010
Changing from 90th to 25th			0.074	0.066
Marginal effects of Corruption				
FD at 25th			−0.581**	−0.511***
			0.229	0.164
FD at 50th			−0.584**	−0.514***
			0.230	0.165
FD at 75th			−0.599**	−0.527***
			0.234	0.168
Changing from 75th to 25th			0.018	0.016

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.

Before discussing estimation results documented in Table 3, two important remarks about interpreting results in models with interaction terms are in order (see, e.g., Brambor et al., 2006; Friedrich, 1982; Hainmueller et al., 2019). First, specifications (1) and (2) will be misspecified if the interaction between financial development and corruption in specification (3) is statistically significant. For this reason, our discussion relies mainly on specification (3). Second, coefficient estimates for financial development and corruption represent the partial effect of one of the variables on firm growth for the empirically irrelevant scenarios when the other variable takes on a value of zero. Hence, we refrain from interpreting these coefficients and instead calculate the marginal effects (and corresponding standard errors) of financial development at typical levels of corruption.

The medium panel of Table 3 documents the marginal effects of local financial development on the growth rate of sales per worker when the level of corruption is set at the 25th, 50th, 75th and 90th percentile of its distribution. These results support two of the three hypotheses. First, supporting hypothesis H_1, the marginal effect of local financial development on firm growth is significantly positive at all the considered levels of corruption. Plotting this effect at all observed levels of corruption, Fig. 1 also confirms that financial development contributes positively to firm growth regardless of the prevailing levels of corruption. This result 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., 2019). Second, consistent with hypothesis H_3, the marginal effect of local financial development decreases when the level of corruption increases. For instance, if the level of corruption decreases from the

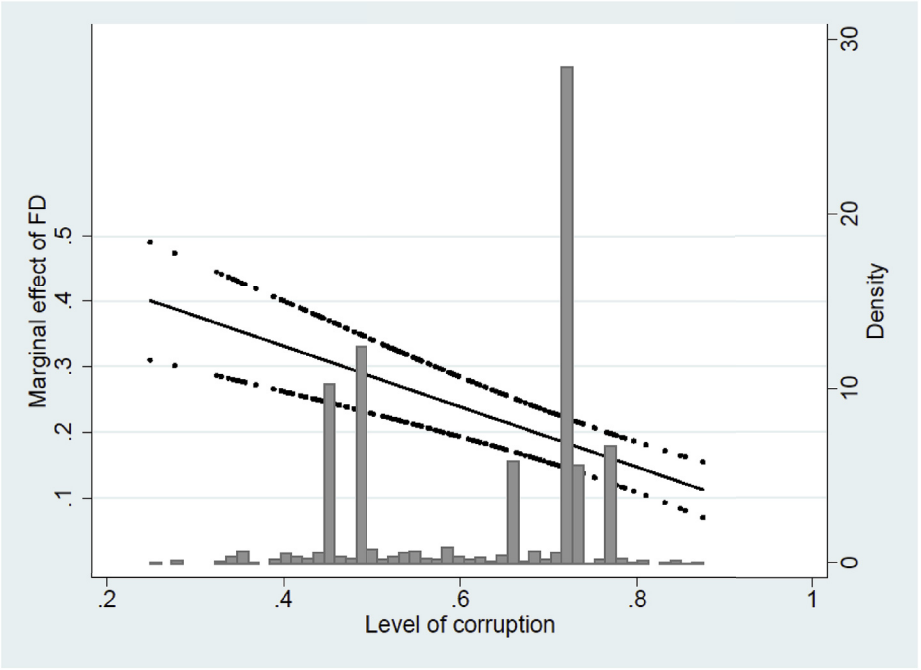


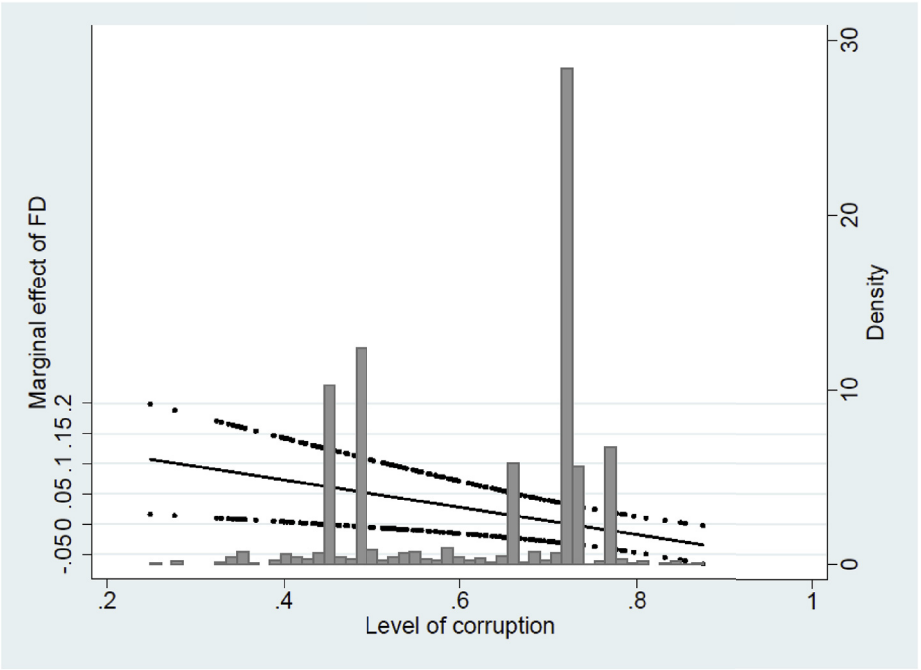
Fig. 1. Marginal effect of financial development on the growth rate of sales per worker. The solid line depicts the marginal effect of local financial development on the growth rate of sales per worker at different levels of corruption. The dotted lines represent the ±2 standard errors confidence intervals for the marginal effect. The marginal effects are computed based on the results documented in specification (3) of Table 3. The histogram in the figure provides the distribution of the data with respect to the level of corruption.

90th percentile to the 25th percentile, the marginal effect of financial development on the growth rate of sales per worker increases by 11.5 and 11.8 percentage points in specifications (3) and (4), respectively. This observation is confirmed by the downward sloping marginal effect of financial development depicted in Fig. 1. The slope of this line is the coefficient for the interaction term between financial development and corruption in specification (3). The fact that this coefficient is significantly negative supports hypothesis H_3: Corruption attenuates the growth-promoting effect of financial development. These results imply that the property rights channel of the interaction between financial development and corruption is stronger than the liquidity channel (see the theoretical discussion in Section 2.3). 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.

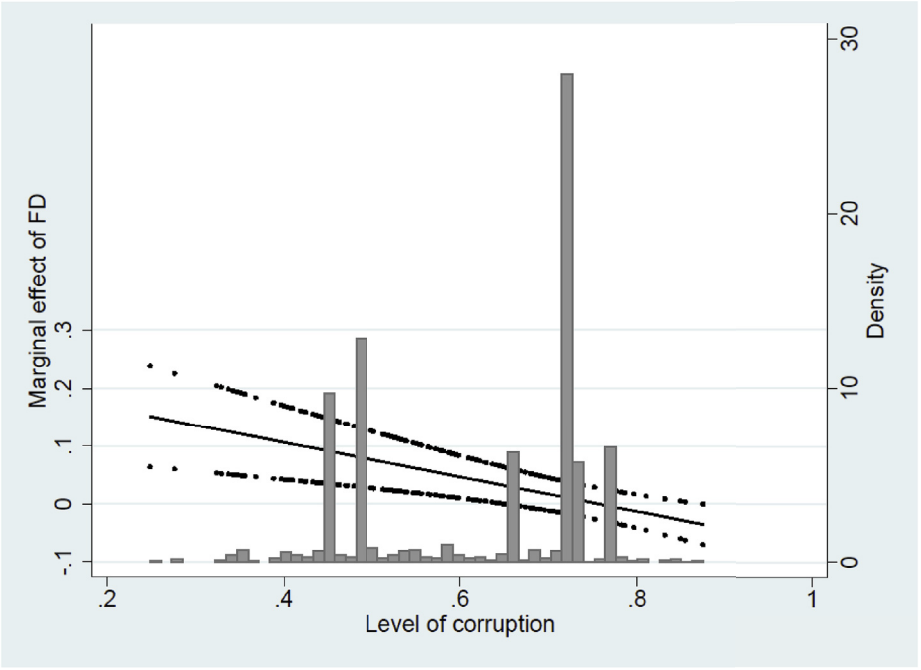
The marginal effects of corruption on the growth rate of sales per worker at typical levels of local financial development are presented at the bottom panel of Table 3. The fact that corruption has a significantly negative effect on the growth rate of sales per worker at all levels of financial development lends support to our hypothesis H_2. These results are in agreement with the literature on the effects of corruption on economic growth in Vietnam (e.g., Tromme, 2016) but contradict with the findings in Wang and You (2012), who document that a high level of corruption promotes the growth of firms in China. Another notable pattern from the marginal effects of corruption is that the growth-impeding effect of corruption gets stronger with increasing levels of financial development. However, the effect is quantitatively small. For instance, an increase in the level of financial development from the 25th to the 75th percentile increases the (negative) marginal effect of corruption on the growth rate of sales per worker increases by just 2.7 and 2.8 percentage points (in absolute terms) in specifications (3) and (4), respectively. This weak but negative relationship between financial development and the marginal effect of corruption on firm growth can also be seen in Fig. B.1. This result is consistent with the property rights channel of the interaction between financial development and corruption in their effects on firm growth.

It is noteworthy that our main findings from Table 3, which support all the three hypothesis, are observed in both specifications (3) and (4). This follows from the fact that estimated interaction effects between financial development and corruption are statistically significant in both specifications. This allows us to rule out the possibility that the interaction effect is simply capturing some kind of non-linearity in the effects of financial development on firm growth (Arcand et al., 2015).

Table 4 documents results on the effects of financial development and corruption on the growth rates of total sales. Similar to the results on the growth of sales per worker, the marginal effect of local financial development on the growth rate of sales is stronger when the level of corruption is lower. However, compared with the marginal effect of financial development on the growth rate of sales per worker, the magnitude is smaller in the case of sales growth. In particular, while the marginal effect of financial development on sales growth is slightly significant (at the 10% level) when corruption is low at the 25th percentile, its impact becomes insignificant with an increase in the level of corruption. Panel (a) of Fig. 2 makes this result more evident: It is only at low



(a) Sales



(b) Investment

Fig. 2. Marginal effects of financial development on growth rates of sales and investment. The solid line in each figure depicts the marginal effect of local financial development on the growth rate of sales (in Figure a) and investment (in Figure b) at different levels of corruption. The marginal effects on growth rates of sales and investment are computed based on the corresponding results documented in specification (3) of Tables 4 and 5, respectively. For further notes, see Fig. 1.

levels of corruption that local financial development has a significantly positive impact on firm growth. Supporting H_3, the negative coefficient on the interaction term between financial development and corruption in Table 4 implies that the two determinants have substitution effects in their effects on sales growth.

The effects of financial development and corruption on the growth rate of investment are presented in Table 5. These results are qualitatively similar to those in Tables 3 and 4. In particular, province-level financial development promotes investment growth

(supporting H_1), while corruption (*IC*) shows a significantly negative impact on investment growth. Moreover, in support of H_3, the interaction between province-level financial development and corruption has a significantly negative impact on investment growth. Similar to the findings in Tables 3 and 4, the marginal effect of local financial development on the growth rate of investment reduces when the level of corruption increases, and vice versa. These results are supported by the marginal effects reported at the medium and bottom panels of Table 5 and in Panel (b) of Fig. 2.

In sum, empirical evidence documented in Tables 3–5 and the corresponding Figs. 1, 2, B.1, B.2 and B.3 support the 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 sales per worker, sales and investment. Moreover, the marginal impact of improving along one dimension (say, financial development) is stronger when the other dimension (say, corruption) is at a lower level.

To further check the robustness of our baseline results, which are obtained by using the number of financial suppliers per 1000 people 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 Tables C.1, C.2 and C.3 of Appendix C and are qualitatively similar to our baseline results.[10] 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 interact negatively in their effects on firm growth (H_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 dataset of more than 40,000 firms spanning the period 2009–2013 and applying a heteroskedasticity-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 interact negatively in their effects on firm growth. Accordingly, the marginal effect of financial development is stronger when the level of corruption is lower, whereas corruption is more costly in the presence of a developed financial sector. 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 weakens the enforcement of property rights, which in turn discourages entrepreneurs from reinvesting their profits, even when they own the collateral required to obtain external finance (e.g., Acemoglu and Verdier, 1998; Johnson et al., 2002). The results may also reflect the possibility that corruption in the financial system diverts credit to unproductive or even wasteful projects (Ghirmay, 2004).

In our robustness checks, we find that our results are 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 the interaction between province-level infrastructural development, financial development and corruption in their effects on firm growth.

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Appendix

A. A brief description of heteroskedasticity-based identification strategy

To provide a brief description of the heteroskedasticity-based identification strategy proposed by Lewbel (2012), we begin by re-writing our model of interest in (1) as

$$Y_1 = X\boldsymbol{\beta_1} + Y_2\gamma_1 + U, \tag{2}$$

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

$$Y_2 = X\boldsymbol{\beta_2} + Y_1\gamma_2 + V. \tag{3}$$

As usual, the structural error terms in models (2) and (3) are assumed to be independent from each other and from the explanatory variables X. The heteroskedasticity-based identification strategy, however, assumes additionally that there exists heteroskedasticity in V (and hence Y_2). Hence, while the usual assumptions are

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

[10] Note that these two financial development indicators have a positive correlation coefficient of more than 0.8.

heteroskedasticity-based identification additionally assumes that

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

To perform a heteroskedasticity-based instrumental variable estimation of (2), Lewbel (2012) suggests to instrument Y_2 by $[X - \text{E}(X)]\widehat{V}$, where $\widehat{V}$ denotes the residuals obtained by estimating equation (3) excluding Y_1 on the right-hand side. This is a potentially valid instrument because $[X - \text{E}(X)]\widehat{V}$ is exogenous in (2) as it is already assumed that $\text{Cov}(X, UV) = 0$ and it is correlated with Y_2 through V. It is worth noting here that the condition $\text{Cov}(X, V^2) \neq 0$ need to hold only for a subset Z of the variables in X.

B. *Marginal effect of corruption on firm growth*

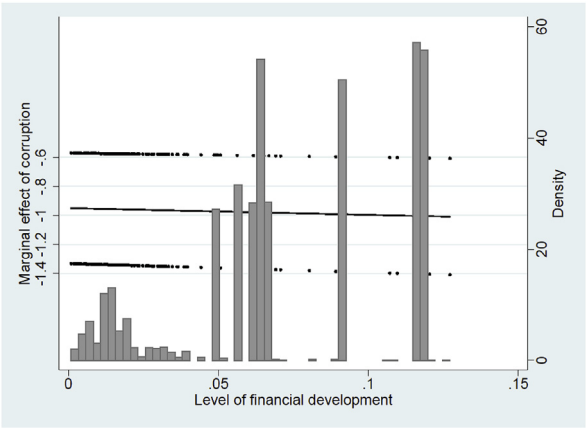

Fig. B.1 Marginal effect of corruption on growth rate of sales per worker. The marginal effects are computed based on the results documented in specification (3) of Table 3. For further notes, see Fig. 1.

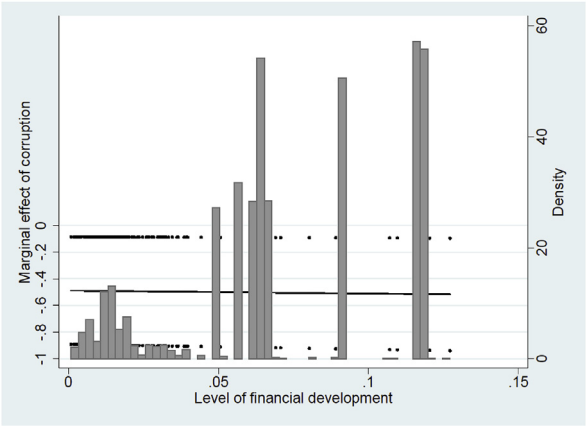

Fig. B.2 Marginal effect of corruption on the growth rate of sales. The marginal effects are computed based on the results documented in specification (3) of Table 4. For further notes, see Fig. 1.

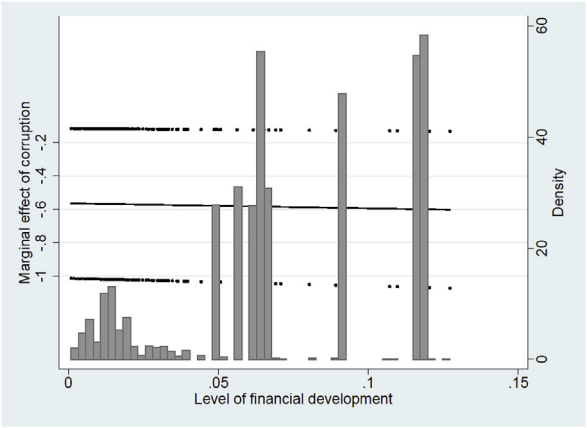

Fig. B.3 Marginal effect of local financial development on the growth rate of investment. The marginal effects are computed based on the results documented in specification (3) of Table 5. For further notes, see Fig. 1.

C. Alternative measure of financial development

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

	Endogeneity treatment			
	FD	FD and IC	FD, IC and FD*IC	FD, IC, FD*IC and *FD2*
	(1)	(2)	(3)	(4)
FD1	0.124**	0.208***	0.421***	0.321***
	(0.053)	(0.034)	(0.067)	(0.044)
Informal charges (IC)	−0.149***	0.149**	−0.309***	−0.275***
	(0.047)	(0.068)	(0.116)	(0.063)
FD1*IC			−0.356***	−0.293***
			(0.085)	(0.037)
Initial	−0.938***	−0.941***	−0.938***	−0.937***
	(0.004)	(0.002)	(0.002)	(0.001)
Labor	0.102***	0.101***	0.099***	0.098**∗
	(0.004)	(0.004)	(0.003)	(0.001)
Asset	0.003	−0.001	0.001	0.002
	(0.002)	(0.002)	(0.002)	(0.001)
Private	−0.054**	−0.044*	−0.070***	−0.068***
	(0.025)	(0.023)	(0.019)	(0.011)
Provincial per capita income	0.002***	0.003***	0.000	0.001***
	(0.001)	(0.001)	(0.001)	(0.001)
FD2				−0.013***
				(0.001)
Year dummies	Yes	Yes	Yes	Yes
Constant	0.002***	0.003***	0.000	0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	133,390	133,390	133,390	133,390
R-squared	0.533	0.532	0.530	0.531
Overidentification	0.041	0.129	0.167	0.266
Weak identification	24.142	16.088	7.857	34.103
Marginal effects of FD				
Corruption at 25th			0.248***	0.234***
			0.029	0.022
Corruption at 50th, 75th			0.164***	0.165***
			0.019	0.015
Corruption at 90th			0.159***	0.161***
			0.019	0.015
Changing from 90th to 25th			0.089	0.073
Marginal effects of Corruption				
FD at 25th			−0.349***	−0.308***
			0.125	
				0.067
FD at 50th			−0.389***	−0.341***
			0.134	
				0.070
FD at 75th			−0.453***	−0.394***
			0.149	0.077
Changing from 75th to 25th			0.104	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 variable is annual growth rate of sales per worker and measured from 2010 to 2013. Province-level financial development is measured by means of the number of financial suppliers per square kilometre. For further notes see Table 3.

Table C.2
The effects on growth rate of sales.

	Endogeneity treatment			
	FD	FD and IC	FD, IC and FD*IC	FD, IC, FD*IC and FD^2
	(1)	(2)	(3)	(4)
FD	−0.054	0.050	0.149***	0.028
	(0.054)	(0.036)	(0.055)	(0.026)
Informal charges (IC)	−0.013	0.025	−0.194**	−0.049
	(0.048)	(0.071)	(0.095)	(0.043)
FD*IC			−0.210***	−0.143***
			(0.064)	(0.024)
Initial	−0.888***	−0.895***	−0.891***	−0.892***
	(0.004)	(0.002)	(0.001)	(0.001)
Labor	0.081***	0.087***	0.084***	0.084***
	(0.003)	(0.003)	(0.001)	(0.001)
Asset	0.008***	0.002	0.003***	0.002***
	(0.003)	(0.001)	(0.001)	(0.001)
Private	−0.032	−0.009	−0.013	−0.010
	(0.023)	(0.022)	(0.021)	(0.019)
Provincial per capita income	−0.002***	−0.002***	−0.003***	−0.001***
	(0.001)	(0.001)	(0.001)	(0.000)
FD^2				−0.016***
				(0.001)
Year dummies	Yes	Yes	Yes	Yes
Constant	−0.000	0.001**	0.000	0.002***
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	133,382	133,382	133,382	133,382
R-squared	0.509	0.509	0.508	0.508
Overidentification	0.411	0.288	0.255	0.313
Weak identification	23.731	15.806	7.057	35.713
Marginal effects of FD				
Corruption at 25th			0.046*	0.027*
			0.027	0.016
Corruption at 50th, 75th			−0.003	−0.007
			0.018	0.013
Corruption at 90th			−0.006	−0.009
			0.018	0.013
Changing from 90th to 25th			0.052	0.035
Marginal effects of Corruption				
FD at 25th			−0.218**	−0.065
			0.101	0.045
FD at 50th			−0.242**	−0.081*
			0.108	0.048
FD at 75th			−0.280**	−0.107**
			0.119	0.052
Changing from 75th to 25th			0.061	0.042

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. Province-level financial development is measured by means of the number of financial suppliers per square kilometre. For further notes see Table 3.

Table C.3
The effects on growth rate of investment.

	Endogeneity treatment			
	FD	FD and IC	FD, IC and FD*IC	FD, IC, FD*IC and FD^2
	(1)	(2)	(3)	(4)
FD	−0.110**	0.039	0.248***	0.111***
	(0.056)	(0.027)	(0.060)	(0.025)
Informal charges (IC)	−0.034	0.107	−0.233*	−0.147***
	(0.063)	(0.077)	(0.122)	(0.049)
FD*IC			−0.320***	−0.235***
			(0.079)	(0.030)
Initial	−0.900***	−0.902***	−0.900***	−0.901***
	(0.004)	(0.002)	(0.002)	(0.001)
Labor	0.100***	0.107***	0.107***	0.108***
	(0.005)	(0.003)	(0.002)	(0.001)
Asset	0.008***	0.002	0.001	0.000
	(0.003)	(0.002)	(0.001)	(0.001)
Private	0.024	0.038*	0.016	0.010
	(0.024)	(0.021)	(0.018)	(0.015)
Provincial per capita income	0.000	0.001	−0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.000)
FD^2				−0.018***
				(0.001)
Year dummies	Yes	Yes	Yes	Yes
Constant	−0.002*	0.001	−0.001**	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Observations	130,193	130,193	130,193	130,193
R-squared	0.497	0.497	0.496	0.496
Overidentification	0.111	0.107	0.117	0.297
Weak identification	26.822	15.098	8.372	28.258
Marginal effects of FD				
Corruption at 25th			0.092***	0.073***
			0.025	0.011
Corruption at 50th, 75th			0.017	0.018**
			0.016	0.007
Corruption at 90th			0.012	0.014*
			0.016	0.007
Changing from 90th to 25th			0.080	0.059
Marginal effects of Corruption				
FD at 25th			−0.269**	−0.173***
			0.131	0.052
FD at 50th			−0.305**	−0.200***
			0.139	0.055
FD at 75th			−0.362**	−0.242***
			0.153	0.060
Changing from 75th to 25th			0.094	0.069

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. Province-level financial development is measured by means of the number of financial suppliers per square kilometre. For further notes see Table 3.

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