Bank Expansion, Firm Performance, and Gender Gaps: Evidence from Vietnam*

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Abstract

Expansion of bank branches has played a pivotal role in enhancing financial development and access to finance. Using firm-level and district-level data from Vietnam during 2007 - 2019, we document that (1) increased bank expansion has a positive impact on a firm's revenue and number of employees, but not on labor productivity; and (2) this result is driven by men-led firms, while for women-led firms, we find no effects on firms' sales, employment and labor productivity. This might be because men-led firms have a higher probability of getting loans compared to women-led firms with increased exposure to banks. Another interesting result is that if firms get loans, women-led firms have a higher probability of adopting modern technologies, such as cloud computing technology, advanced robots, and additive manufacturing technology (3D printing), with an increase in exposure to banks. Our results highlight the importance of bank expansion in increasing firms' performance in developing countries, but suggest more policies in supporting women-led firms in accessing to banks, apart from increasing the number of bank branches.

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1 Introduction

Over the past few decades, the expansion of bank branches has played a pivotal role in enhancing financial development and access to finance (King and Levine, 1993; Burgess and Pande, 2005; Fafchamps and Schündeln, 2013; Célerier and Matray, 2019). While broader relationship between national financial development and economic outcomes has been extensively studied (Arestis and Demetriades, 1997; Arcand et al., 2015; Baltagi et al., 2009) [1]., less attention has been given to the within-country and gender-gap variations in financial access.

Why bank branches expansion can help to increase financial access? This goes back to a rich literature discussing the important role of distance in investment (Helpman, 1984) or trade (Tinbergen, 1962; Krugman, 1991) in which they emphasize on the idea of agglomeration economies or how geographic proximity can help to reduce the costs of transferring labor, goods and encourage spillovers of knowledge. Another explanation might go back to theory of asymmetric information and transactions costs suggesting that the physical distance between lenders and borrowers can significantly influence access to finance (Fafchamps and Schündeln, 2013). When lenders and borrowers are geographically distant, it becomes more challenging for lenders to observe borrowers' actions, which can exacerbate issues of adverse selection and moral hazard (Petersen and Rajan, 2002). These challenges are particularly pronounced in less developed economies, where localized financial development may have a more pronounced impact on firm performance. Even though the development of technologies helps to lower the costs of transmitting and processing information, especially in banking sectors where they are investing billions of dollars into online financial technology services, distance still matters, as pointed out by Nguyen (2019); Bonfim et al. (2021).

But whether bank branches expansions can help to reduce the gaps between women- and men-led firms to access to finance? Evidence have shown that women-led firms are less likely to gain access to financial services than male-owned firms in various contexts worldwide. As women are less likely than men to own property, collateral requirement significantly hinder women-led firms' ability to access loans. In addition, women-led firms may be less networked than their male counterparts and so derive less benefit from agglomeration. They may also have greater domestic burdens and therefore have higher commuting costs (Rosenthal and Strange, 2012). Therefore, bank branch expansion might help to solve the disparities.

This paper tests whether bank expansion matters for firm performance in Vietnam and whether the benefits are different between women- and men-led firms. To this end we combine data on bank expansion at the district level with firm census data over the period 2007 to 2019 to study the effect of bank expansion on firm performance, and the heterogeneity between women- and men-led firms. We find that bank expansion is correlated with firm's performance by increasing their sales and their number of employees, but not on labor productivity. However, we find the improvement on firms' performance is driven by men-led firms, and do not find statistically significant effect for female-led firms. Although this finding is surprising, we argue that bank expansion is important, however, making a policy that specifically targets women might be more beneficial to solve the gender-gap problem. There might be many explanations to explain this finding, for example: women-led firms still suffer from discrimination in credit lending from banks (even though more banks are located in the local areas).

Related Literature. First, this paper contributes to literature on financial access and their impact on firm performance. It builds upon a broad array of studies that investigate banking sector outreach, for example Beck et al. (2008) who measured access barriers in 62 countries. Prior research has also explored how improvements in bank access affect usage (Agarwal and Hauswald,

[1] See (Ang, 2008) for a survey of this literature.

2010; Bachas et al., 2018).

Second, the paper links to the large literature looking at the gender perspective in accessing fo finance, and the role of bank expansion. Garg et al. (2024) find that the benefits of being close to a bank are influenced by local gender norms. Women-owned enterprises experience the most significant gains in villages with more liberal social norms. Chaudhuri et al. (2020), on the other hand, look at women-owned firms and find that they face disadvantages in accessing small-business credit. Therefore, addressing gender discrimination in the small-business credit market could help reduce the performance gap between men- and women-owned firms.

The remainder of this paper is structured as follows. The next section explores the conceptual framework and setting up our hypotheses, and then explain institutional context that highlights the transformation of bank deregulation in Vietnam. We then present our data and methodology, followed by a discussion of the study's findings. Finally, we conduct additional robustness check and suggest some potential mechanisms, and conclude the paper.

2 Conceptual Framework and Background

2.1 Conceptual Framework

Physical bank branches are still an important modes of bank access for firms even though with the development of online and mobile banking, for example in the US (Nguyen, 2019; Célerier and Matray, 2019), in India (Garg et al., 2024), or in Brazil (Fonseca and Matray, 2024). Many firms continue to favor personal interactions for general banking services, complex transactions, and financial advice. Deloitte in 2019 surveyed 17,100 banking consumers across 17 countries to measure a range of banking attitudes, behaviors, and preferences. The survey revealed that the majority prefer visiting branches over using online or mobile banking for opening accounts, such as mortgages, wealth management, checking, and credit cards (Srinivas and Wadhwani, 2019). Bank branches serve as symbols of trust, enhancing brand recognition and security while supporting face-to-face, personal banking relationships (Srinivas and Wadhwani, 2019). Survey evidence consistently indicates that consumers place a high value on having accessible bank branches and ATMs in close proximity. Novantas conducted a survey in 2020 and found that a majority of respondents expressed a strong preference for their banks to maintain branches near their homes or workplaces. This may be even more important for consumers as a business, than households or individuals. Mercator Advisory Group conducted a survey with small business owners and highlighted the strong reliance of small business owners on physical bank branches. They find that 79% of small business owners visited a branch at least once a week, with 24% making daily visits. These findings underscore the critical role that physical branches continue to play in the daily operations of small businesses (Sakong and Zentefis, 2023). These findings underscored the role of bank branches for firms even with the rise of online and mobile banking services. If firms can have more access to bank services through increasing the number of banks they can access in their areas, firms now can have better access to loans, which is a means to overcome their challenges in credit limits, and they can use the loans to buy better inputs, expand to foreign markets, or adopt better technologies. Therefore, our first hypothesis is that:

Hypothesis 1: Firms increased their sizes (sales and number of employees) with an increase of exposure to banks.

The relationship between bank branch expansion to labor productivity may be more overarching. The productivity of firms in developing countries are extremely low (Bloom et al., 2010). This is due to a set of issues around infrastructure, informality, regulations, trade policies, human capital, management practices, financial constraints, and the delegation of decision making (Tybout, 2000;

Ferreira and Walton, 2005; Bloom et al., 2010). Firms could get access to loans by an increase in bank branches presence, however, whether these loans turn into labor productivity depends on many factors. For example, Pagano and Pica (2012) find that when using international industry-level data from 1970 to 2003, traditional indicators of financial development are significantly linked to higher employment growth. However, this positive association is observed exclusively in non-OECD countries. In contrast, they find no meaningful correlation between financial development and either labor productivity or real wage growth. This suggests that while financial development may stimulate job creation in developing economies, it does not necessarily translate into gains in productivity or wage increases within the same context.Therefore, our second hypothesis is: ***Hypothesis 2: Firms do not gain in labor productivity with an increase of exposure to banks***.

Bank branches are not only vital to the general public but also can play a crucial role in solving a gender problem. Empirical research has shown that when bank open more branches, there is an increase in female entrepreneurship (Garg et al., 2024). Women-led firms often face significant credit constraints due to a variety of factors. These constraints are, for example, characteristics of their firms, such as size, age, sector type, foreign ownership, or location, or external factors, like level of literacy, occupation, age, education, and intra-household dynamics (Ghosh and Vinod, 2017; Garg et al., 2024). Additionally, the physical distance to bank facilities can be a more significant barrier for women than for men due to their greater responsibilities in household chores and the prevalence of violence against women in many societies. For example, women in India often face restrictions on their mobility within their neighborhoods due to actual or perceived threats of violence (Field et al., 2010). Cultural attitudes towards household responsibilities and childrearing further restrict women's mobility. Women may also have greater domestic burdens and therefore have higher commuting costs (Rosenthal and Strange, 2012). Therefore, bank branches expansion might help to solve the gender disparities, we set up our third hypothesis:
Hypothesis 3: Women-led firms benefit more with an increase in exposure to banks.

Overall, bank branches continue to play a vital role in the financial lives of most firms, and the presence and expansion of bank branches may help to solve gender issues in firm performance.

2.2 Background

Vietnam began shifting from a centrally planned system to a market-based one in 1986 with the policy called "Doi Moi". These reforms spurred rapid economic growth, but they also triggered high inflation. In 1986, Vietnam replaced its mono-tier banking system with the creation of four state-owned commercial banks (SOCBs) (Ferrari and Tran, 2021). However, the banking sector remained centrally planned until the late 1990s, leading to many issues: continued state involvement in the economy and banking, high levels of non-performing loans from past practices, resource misallocation, low capitalization, inefficiency, and an overreliance on the banking sector due to underdeveloped capital markets.

The first wave of financial reforms began in the late 1990s, focusing on developing a legal framework for banking operations, strengthening supervisory rules, and implementing asset classification and provisioning laws. Minimum capital requirements were raised, while state protection for SOCBs was gradually reduced. A significant milestone in financial liberalization was Vietnam's accession to the WTO in 2007, which opened the banking sector to foreign banks, allowing them to establish subsidiaries and engage in the same activities as domestic banks. This period also saw foreign investors being permitted to acquire shares in Vietnamese joint-stock commercial banks (JSCBs). The privatization process began in 2010, followed by the implementation of restructuring policies in 2011 in response to the Global Financial Crisis (GFC) and the sharp decline in real estate prices

(Ferrari and Tran, 2021). Therefore, we want to focus on the bank branch expansion since 2007 to account for the changes and involvement of foreign banks and privatization of banks in Vietnam during this period. Figure 1 shows the rapid expansion of bank branches from 2007 onwards. The year 2013 stands out with an unprecedented spike, where 583 new banks were established. Initially, there is a rising trend from 2007 with many new banks were established and the number reaches a peak at year 2013. There is a marked decline post 2013, particularly a sharp decline between 2016 and 2017, descending to a low of 29 new banks by 2017. The years towards the end of the period, especially 2017 and 2019, exhibit the lowest activities in bank establishments, possibly indiating market saturation or a change into digital bank.

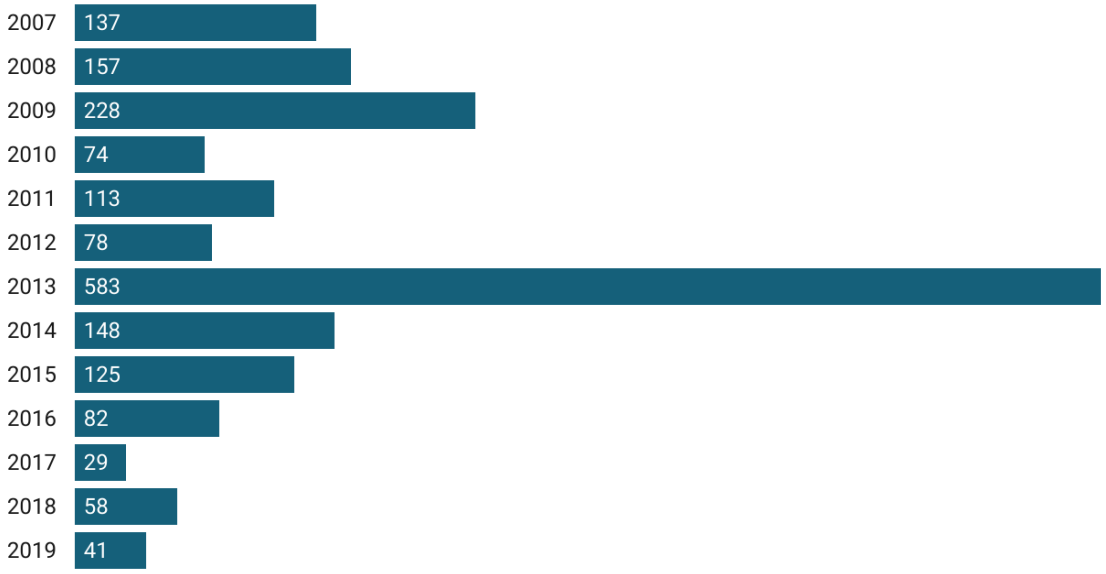

Figure 1: Number of new banks established from 2007 - 2019 in Vietnam.
Source: Compiled by the author

Figure 2 and 3 illustrate the distribution and expansion of bank branches across Vietnam in the years 2007 and 2019. A marked increase in the density and geographic spread of bank branches is evient, with 2019 showing a significantly broader and more dispersed banking network compared to 2007. Initially, larger concentrations of bank branches were predominantly situated in major urban centers (Hanoi and Ho Chi Minh City); however, by 2019, an expansion into more rural and less economically developed regions can be observed.

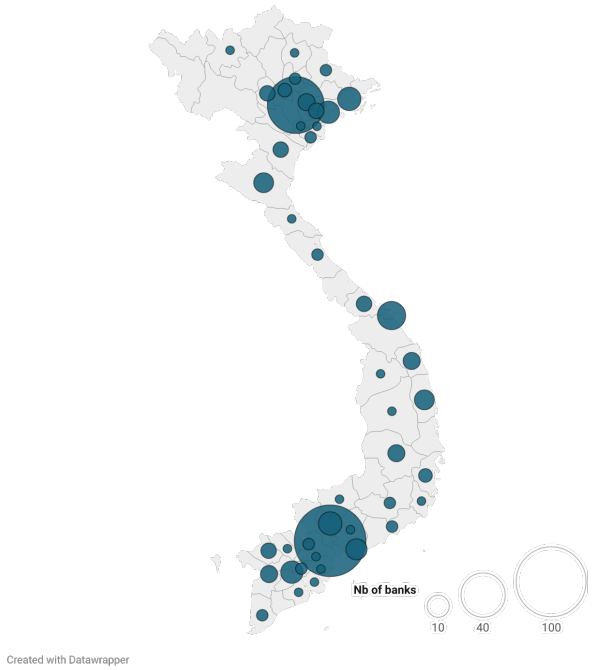

Figure 2: Map of bank branches in Vietnam in 2007.
Source: Compiled by the author

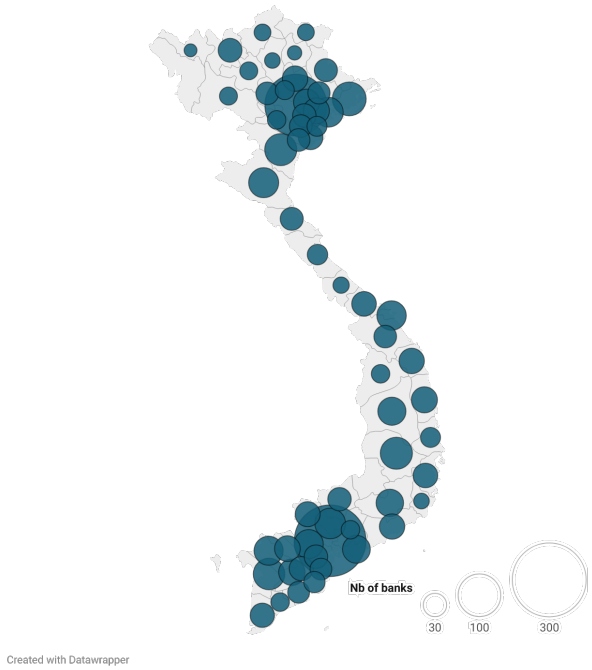

Figure 3: Map of bank branches in Vietnam in 2019.
Source: Compiled by the author

3 Data

3.1 Data sources

We use three main data sources for this paper: Vietnam Enterprise Survey, Banks data, and Orbis dataset.

Vietnam Enterprise Survey: The Enterprise Survey collects information from all firms operating in Vietnam on their identification, industry activities, labor, and firms' outcomes. The main information includes firm identification (name, address, activities, business type, and branches); labor and income (number of employees and their income, etc.); firms' results and costs (performance, expenses, investment, product output, energy use, etc.); and sometimes information about export and import activities of the firm.

The Survey is conducted by General Statistics Office of Vietnam, and is collected annually starting from 2000. We have available data from 2000 - 2019, but we will focus on the period from 2007 - 2019 due the WTO participation of Vietnam and deregulation of banks in Vietnam during this period. We use information from year 2001 to have a baseline number of firms in each district in year 2001 to calculate the adjusted expansion of banks. We use "ma_thue" variable (tax identification number - unique for each firm across years) to create a panel data from 2007-2019 [2]. The "ma_thue" variable is a 10-digit character to identify each firm and the tax office that they

[2]McCaig et al. (2022) use "madn" to match between years. Indeed, this variable does not have many duplicates like "ma_thue", however, as we want to check firms' names and address later with the government website providing information related to tax id, firms' names, and address, we prefer to use "ma_thue" to match between years. In addition, for some years like 2000-2010 or year 2014 without "ma_thue" or 9-digit "ma_thue", we also use madn and other variables to identify firms

belong to. However, the data from 2000-2010 includes the "ma_thue" variable with only 9-digit character, instead of 10-digit character. Therefore, to match between these two different periods, we use 9-digit tax identification.

Banks dataset: We use the dataset by Le et al. (2022) as a reference to identify which banks operating in Vietnam during our interested time period 2007 - 2019. Then manually collect the data related to the branches of each firm, their address, and their established year. We explain the process of our cleaning in the section 3.2.1.

Orbis dataset: The Orbis Global database, from Bureau van Dijk (BvD) - a Moody's Analytics company - is the largest cross-country firm-level database that combines both, encmpassing firms' financial statements, their real activity in terms of sales, employment, and investment, and most importantly, gender of the owner of the firm. For Vietnam, with the most updated version of Orbis [3], we have more than 1,200,000 firms. We will use this dataset to get information about gender of the owner of the firm.

3.2 Variables

3.2.1 Exposure to Banks

Baseline number of firms: To construct the variable measuring exposure to banks, we start by identifying the baseline number of firms in each district d. This is represented as the number of firms in each district as of the year 2001 [4]. This baseline measure is crucial as it reflects the economic activity and potential demand for banking services within each district. Let $Nf_{d,2001}$ denote the number of firms in district d in the year 2001.

Number of banks in the district: Next, we collect data on the number of banks in each district. We use the dataset by Le et al. (2022) to identify the firms that operate in Vietnam from 2007 - 2019. The dataset provides us the list of the firms operating in Vietnam from 2002 to 2021 and the time period of their activities. They collect this data based on annual report from each bank. The dataset also provides us information about number of branches for each bank during the period. We exclude banks that only temporary operating in Vietnam [5]. However, this dataset does not provide us data related to number of bank branches for each year and when they were established. We manually collect this dataset by checking the tax code of each bank, and then search for their branches from the website masothue.com [6], which then provides us detailed data related to bank address and established year. We only focus on branches of banks (Chi nhanh), not transaction office (Phong giao dich). The reason is we do not have complete information about the transaction offices for each bank. This is because transaction offices often do not have a separate tax identification number, unlike branch. We argue that this will not cause a bias to our exercise, because firms usually go a bank branch to get credits, rather than using transacton office which more often serves households and individuals [7]. This metric indicates the availability of banking services within the district. Let Nb_{dt} represent the cumulative number of banks in district d at time t. Our baseline measure of the adjusted expansion of banks in district d at time t is given by:

[3] accessed in July, 2024

[4] We chose the year 2001 as our baseline to calculate the share of of firms in a district since the VES dataset starts from year 2000, however, there is a difference in a way to tracking id firms in year 2000 and year 2001, so we focus on year 2001 as our baseline.

[5] These include banks that according to the dataset by Le et al. (2022) only operates in Vietnam for 3 or 4 years.

[6] Since 2009, there is a change in the tax identification system in Vietnam, from 9 digit to 10 digit, and the last 3 digits will be the branch identification of a firm.

[7] The maximum amount that a transaction office can lend is 2 billion VND, larger than that, a transaction office needs to ask permission from the branch office. Therefore, usually, firms can go directly to the branch office to borrow money.

$$AEB_{d,t} = \frac{Nb_{d,t}}{Nf_{d,2001}}, \tag{1}$$

where Nb_{dt} represents the number of banks in district d at time t, and $Nf_{d,2001}$ represents the baseline number of firms in district d.

3.2.2 Firm performance

We focus on three measures: revenue, number of employees, and labor productivity as proxies for firm performance. Revenue and number of employees variables are extracted and transformed from the Vietnam Enterprise survey from 2007 - 2019. We use these two variables with log transformation. For labor productivity, we take value added over number of employees, in which value added is measured by using total revenue minus total costs of goods sold. We also check with another versions of labor productivity, for example, taking depreciation or other variables related to costs into the function, however, because these variables are not well recorded so we decide to use the simplest version to measure labor productivity. Labor productivity when taking into regression is also used in log form. A summary statistics of these three variables are given in the table 1.

To test the mechanisms, we also use other measure related to firm performance: probability of getting loans and technology adoption.

3.2.3 Other variables

Another main important aspect of our paper is gender difference. The Vietnam Enterprise Survey does ask these questions in their survey for year 2011, 2013, and 2016. However, in our data provided by the General Statistics Office, we are not provided with the variable related to gender.

Therefore, we opt for Orbis dataset which also provides a comprehensive coverage of Vietnamese firms. As mentioned before, the total number of firms provided in the dataset is more than 1,200,000 firms (version updated in July, 2024). The Orbis dataset also provides us the information in terms of gender of the owner of the firm in the latest year. We extract this variable from Orbis dataset along with tax identification, then we match this extracted dataset with our main dataset from Vietnam Enterprise Survey based on tax identification to have the gender of the owner of each firm. Because this gender variable from Orbis dataset only provides the information according to the latest year that they appear in the Orbis dataset, so we have to make assumption that this variable does not change over time.

We also use other variables as control variables, for example: types of firms (foreign, state, or private domestic), whether they are in the Special Economic Zone areas, and the sector that they are in. These variables are also from Vietnam Enterprise Survey.

3.2.4 Summary statistics

Table 1 describes summary statistics of our most important variables: exposure to banks, sales, number of employees, labor productivity. The unit of observation here is at firm level. We can see the differences between female-owned enterprises and male-owned enterprises in terms of firm performance variable. Female-owned firms, generally, have lower average sales, average number of employees and average labor productivity. Exposure to banks in female-owned firms are higher compared to male-counterparts.

Table 1: Summary statistics

	Female		Male		All	
	Nb of obs	Mean	Nb of obs	Mean	Nb of obs	Mean
Exposure to banks	364,971	0.0933	1,594,941	0.0928	1,959,912	0.0929
Sales	364,971	33,474.22	1,594,941	48,270.13	1,959,912	45,514.86
Number of employees	364,971	28.36	1,594,941	37.44	1,959,912	35.75
Labor productivity	356,391	305.56	1,555,305	313.22	1,911,696	311.79

4 Methodology

4.1 Empirical Approach

To formally examine the impact of exposure to banks on firm performance, we use a fixed effect framework that controls for various confounding factors. Our baseline empirical specification is as follows:

$$\mathrm{Y}_{idt} = \alpha + \beta_1 \text{Exposure to banks}_{dt} + \delta_t + \zeta_i + \epsilon_{idt}, \tag{2}$$

In the main results, we estimate Eq. 2 using data from 2007 to 2019. In this specification, we thus identify the effect of exposure to banks using variation in exposures across districts at a specific point in time, conditional on time period and firm fixed effects δ_t and ζ_i. The main dependent variable $\Delta \mathrm{Y}_{idt}$ include different firm performance indicators including: revenue, number of employees, and labor productivity - measured in log. We cluster the standard errors at firm level. In our robustness check, we cluster standard errors at district level (the level where we have variations in exposure to banks with this current measure of exposure).

Our branch expansion is endogenous, which creates significant challenge to identify its effects on firm performance. Banks tend to open branches in areas that show promising growth potential, with high business activity, and suggesting future growth opportunities. Therefore, the above regression mainly suggests a simple correlation between exposure to bank expansion and firm performance, Addressing this endogeneity is difficult due to lack of external variations in branch locations. We can use Difference-in-Differences (DiD) approach - which is a common method - to solve the problem endogeneity by comparing between treatment (firms in districts which have at least one bank), and control (firms in districhts do not have any banks). However, its success depends on the comparability of treatment and control groups. The bank expansion seem to focus on the most crowded area creates selection bias and to identify a comparable treated and control group is difficult. Moreover, due to the government's policy, almost every district/city in Vietnam has already at least a bank branch established - which is a challenge for us to find a comparable control group. Therefore, we implement an instrumental variable (IV) approach by instrumenting AEB_{dt} with $\overline{AEB}_{dt}$. Specifically, we use the average changes in adjusted exposure to banks in five other districts located in different provinces from the one where firm i is situated, but within the same region with a comparable growth rate of output. By focusing on these five comparable districts within the same region, we aim to isolate the source of variation coming from the general change in a broad region (rather than idiosyncratic district factors). Similar to Eq. 1, we have our instrument $\overline{AEB}_{jt}$ is given by:

$$\overline{AEB}_{jt)} = \frac{1}{4} \sum_{j \in r} \frac{Nb_{jt}}{Nf_{j,2001}}, \tag{3}$$

where g_{jt} is the growth rate of output in district j at time t, and $Nf_{j,2001}$ represents the baseline number of firms in district j. District j refers to 4 other comparable districts in terms of growth rate of output within the same region r where district d is located.

4.2 Assessing the Validity of our Design

A main threat to the identifying assumption behind our estimates is the district that have more banks expanded may be affected by other positive shocks. Our estimates might confound the impact of bank expansions with these preexisting district trends. For our instrument variable to be valid, this instrumental adjusted exposure to banks from other districts with similar sales growth only affects firm performance in the district through the exposure to banks that are established here. We confirm with our F-test for weak instrument and the correlation between instrument variable and instrumented variable with our results shown in section 5.1. In addition, since we also use the structure of firms in 2001 (number of firms) in our measure of exposure to banks, it, by itself, shows the historical performance of the district and may not affect the firm performance in year 2007. Other papers also use historical characteristics of a district/ county to instrument for skill composition of a city (Rossi-Hansberg et al., 2019), or for infrastructure (Duranton and Turner, 2011). Usually historical should be 10-30 years difference, but due to data availability, the earliest firm composition data that we could get is 2001. Therefore, although we try to resolve the problem of endogeneity, our instrument may still not be perfect, and what we aim to say in our paper is correlation relationship, rather than a true causal relationship. In addition, when we use exposure to banks from 4 similar districts in different province but in the same region, our instrument is close to Jia et al. (2022) where they use the interaction of average changes in flood risk in the rest of the state and a county's own geo-climatic features to predict a county's risk change.

5 Results

5.1 Main results

Panel A in Table 2 presents the firm-level impact of exposure to bank on firm's revenue, sales, and labor productivity. The three first columns show the results of OLS regression, and the three last columns show the results of IV regression. In all columns, we use firm and year fixed effect and cluster at firm level. In column (1), we only control for province dummies. In column (2), we control for province dummies, foreign dummies (whether a firm is a foreign firm) and state dummies (whether a firm is a state firm). In column (3), we control for province dummies, foreign dummies, state dummies and manufacturing dummies (whether a firm is the manufacturing sector). We find that the estimated impact of exposure to bank is stable, regardless of whether we control for province dummies, type of firms dummies, or manufacturing dummies. Column (4), (5), and (6) are also similar to column (1), (2), and (3) in the types of control variables.

We highlight three empirical findings. First, panel (A) shows that increased exposure to bank positively affected firm's revenue. In terms of the magnitude, for OLS regression, one unit increase of exposure to banks increased revenue by 2.5%. The magnitue is larger when we use IV regression - when one unit increase of exposure to banks increased revenue by 15.3%. The results are stable when we add different controls. Our test for the validity of our instrument variable shows that our instrument variable is correlated with our instrumented variable (the coefficient in the first stage is 0.046 and statistically significant at 1%), and it is not a weak instrument variable with Anderson-Rubin Wald F test ranges from 9.18 - 9.43. These results confirm the validity of our

instrument. This finding may suggest an agreement with our hypothesis that bank expansion helps firms to increase their revenue.

Second, panel (B) indicate that an increase in exposure to bank significantly increased employment and, to a smaller magnitude than the effect on revenue. Specifically, a one unit increase in exposure to banks increased number of employees by 1.0 - 1.2% with OLS regression, and by 5.6 - 5.9% with IV regression. The instrument validity test also confirms that our instrument is correlated with instrumented variable, and it is not a weak insrument. The Anderson-Rubin Wald test is 4.26 - 4.76. Our finding on the employment increase in response to exposure to bank is natural, as with more support from the banks and easier to connect with banks, firms can expand their business - and increase their number of employees.

Finally, we do not see any effect on labor productivity. The results are not statistically significant in all OLS and IV regression. The coefficient for labor productivity is even negative for IV regression, however, they are not statistically significant. In addition, if we have labor productivity as our dependent variable, our instrument in this case seems not to be a goot fit (as shown in the Anderson-Rubin Wald F Test).

Table 2: The impact of the exposure to banks on firms

	Estimates for revenue, number of employees, and productivity (2007-2019)					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Log revenue						
AEB	0.025***	0.025***	0.025***	0.153***	0.155***	0.155***
	(0.006)	(0.006)	(0.006)	(0.051)	(0.051)	(0.051)
First stage:						
$\overline{AEB}$				0.046***	0.046***	0.046***
				(0.002)	(0.002)	(0.002)
Observations	1,913,539	1,913,539	1,913,539	1,518,053	1,518,053	1,518,053
Anderson-Rubin Wald F Test				9.18	9.41	9.43
Panel B. Log number of employees						
AEB	0.010***	0.012***	0.012***	0.056***	0.057***	0.059***
	(0.004)	(0.004)	(0.004)	(0.027)	(0.027)	(0.027)
First stage:						
$\overline{AEB}$				0.046***	0.046***	0.046***
				(0.002)	(0.002)	(0.002)
Observations	1,917,191	1,734,065	1,734,065	1,521,068	1,521,068	1,521,068
Anderson-Rubin Wald F Test				4.26	4.54	4.76
Panel C. Log labour productivity						
AEB	0.005	0.005	-0.0005	-0.082	-0.082	-0.082
	(0.005)	(0.005)	(0.006)	(0.322)	(0.060)	(0.060)
First stage:						
$\overline{AEB}$				0.047***	0.047***	0.047***
				(0.002)	(0.002)	(0.002)
Anderson-Rubin Wald F Test				1.87	1.85	1.88
Observations	1,688,827	1,688,827	1,526,818	1,350,400	1,350,400	1,350,400
Controls & sample restrictions:						
Province dummies	✓	✓	✓	✓	✓	✓
Foreign dummies		✓	✓		✓	✓
State dummies		✓	✓		✓	✓
Manufacturing dummies			✓			✓

Notes: Estimates of the impact of the exposure to banks on firm's revenue, number of employee, and labor productivity. Standard errors are robust against heteroscedasticity and allow for arbitrary clustering at the firm level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level.

5.2 Women- vs men-led firms' performance

Another aspect that makes bank expansion interesting is its impact on gender equality. As shown in our conceptual framework, women-led firms may benefit more from bank expansion as women

usually have more difficulties in terms of transport, especially in long distance. If there are more banks existed, women-led firms could have easier access to banks and then get easier loans, and from that, can improve their performance. We show the results of our exercise when running the main equation 2 with only women-led firms.

The results are shown in table 3. Surprisingly, we do not see any effects of exposure to banks to women-led firms' revenue, number of employees, and labor productivity. Due to limited number of observations, we cannot run IV regressions for women-led firms, so the results in table 3 only shows OLS results. All the results are not statistically significant. We reject our initial hypothesis. However, we could interpret that for women-led firms to have access to banks, increasing the number of banks is not enough. There are more challenges for women to access to banks, for example: implicit bias, or not having enough collateral property to borrow from banks. We confirm this explanation in section 6.1, where we test some potential mechanisms, for example probability of getting loans from banks for women-led firms and men-led firms.

Table 3: The impact of the exposure to banks on women-led firms

	Estimates for revenue, number of employees, and productivity (2007-2019)		
	OLS		
	(1)	(2)	(3)
Panel A. Log revenue			
AEB	0.009	0.008	0.008
	(0.014)	(0.014)	(0.014)
Observations	356,250	356,250	356,250
Panel B. Log number of employees			
AEB	0.008	0.007	0.008
	(0.008)	(0.008)	(0.008)
Observations	356,806	356,806	356,806
Panel C. Log labour productivity			
AEB	-0.012	-0.012	-0.012
	(0.013)	(0.013)	(0.013)
Observations	314,298	314,298	314,298
Controls & sample restrictions:			
Province dummies	✓	✓	✓
Foreign dummies		✓	✓
State dummies		✓	✓
Manufacturing dummies			✓

Notes: Estimates of the impact of the exposure to banks on women-owned firm's revenue, number of employee, and labor productivity. Standard errors are robust against heteroscedasticity and allow for arbitrary clustering at the firm level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level.

The results for men-led firms are shown in table 4. Our main result in 2 is mainly driven by men-led firms. Men-led firms increase their revenue and number of employees, but not labor

productivity when they are more exposed to banks.

Table 4: The impact of the exposure to banks on men-led firms

	Estimates for revenue, number of employees, and productivity (2007-2019)					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Log revenue						
AEB	0.028***	0.029***	0.029***	0.169***	0.170***	0.170***
	(0.007)	(0.007)	(0.007)	(0.051)	(0.056)	(0.056)
First stage:						
$\overline{AEB}$				0.046***	0.046***	0.046***
				(0.002)	(0.002)	(0.002)
Observations	1,557,289	1,557,289	1,557,289	1,234,384	1,234,384	1,234,384
Anderson-Rubin Wald F Test				9.19	9.27	9.28
Panel B. Log number of employees						
AEB	0.011***	0.011***	0.011***	0.049*	0.050*	0.051*
	(0.004)	(0.004)	(0.004)	(0.027)	(0.030)	(0.030)
First stage:						
$\overline{AEB}$				0.046***	0.046***	0.046***
				(0.002)	(0.002)	(0.002)
Observations	1,560,385	1,560,385	1,560,385	1,236,927	1,236,927	1,236,927
Anderson-Rubin Wald F Test				2.74	2.83	2.92
Panel C. Log labour productivity						
AEB	0.009	0.009	0.009	-0.073	-0.072	-0.072
	(0.006)	(0.006)	(0.006)	(0.066)	(0.066)	(0.066)
First stage:						
$\overline{AEB}$				0.047***	0.047***	0.047***
				(0.002)	(0.002)	(0.002)
Anderson-Rubin Wald F Test				1.20	1.19	1.19
Observations	1,374,529	1,374,529	1,374,529	1,098,261	1,098,261	1,098,261
Controls & sample restrictions:						
Province dummies	✓	✓	✓	✓	✓	✓
Foreign dummies		✓	✓		✓	✓
State dummies		✓	✓		✓	✓
Manufacturing dummies			✓			✓

Notes: Estimates of the impact of the exposure to banks on men-led firm's revenue, number of employee, and labor productivity. Standard errors are robust against heteroscedasticity and allow for arbitrary clustering at the firm level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level.

5.3 Robustness Check

We conduct an additional check for robustness. We remove firms located in the special economic zones. Since firms located in the special economic zones may have a better policy in terms securing loans from banks and if they account for a large portion of our firms in the sample, our results may be biased.

5.3.1 Remove firms located in the special economic zones

We remove firms located in the special economic zones. Vietnam has been conducted extensive industrial policy to attract foreign investment by setting up special economic zones. The firms located in these special zones usually get preferential tax and loans from banks in Vietnam. Therefore, with their existence in our sample, it may bias our results - since these firms are technically different from other firms, and they also receive preferential loans compared to other firms in Vietnam. We remove these firms from our sample to examine if the results are still robust. The results are shown in table 5. As shown in tale 5, the results are robust and similar to our main regression table 2 even when we remove firms located in the special economic zones area.

Table 5: The impact of the exposure to banks on firms - Removing firms in Special Economic Zones areas

	Estimates for revenue, number of employees, and productivity (2007-2019)					
	OLS			IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Log revenue						
AEB	0.018***	0.019***	0.019***	0.158***	0.160***	0.160***
	(0.006)	(0.006)	(0.006)	(0.051)	(0.051)	(0.051)
First stage:						
$\overline{AEB}$				0.045***	0.045***	0.045***
				(0.002)	(0.002)	(0.002)
Observations	1,858,647	1,858,647	1,858,647	1,473,669	1,473,669	1,473,669
Anderson-Rubin Wald F Test				9.31	9.57	9.57
Panel B. Log number of employees						
AEB	0.003	0.003	0.003	0.057**	0.059**	0.059***
	(0.004)	(0.004)	(0.004)	(0.028)	(0.028)	(0.028)
First stage:						
$\overline{AEB}$				0.046***	0.046***	0.046***
				(0.002)	(0.002)	(0.002)
Observations	1,861,678	1,861,678	1,861,678	1,476,121	1,476,121	1,476,121
Anderson-Rubin Wald F Test				4.29	4.61	4.76
Panel C. Log labour productivity						
AEB	0.013**	0.013**	0.013**	-0.084	-0.084	-0.084
	(0.006)	(0.006)	(0.006)	(0.062)	(0.062)	(0.062)
First stage:						
$\overline{AEB}$				0.047***	0.047***	0.047***
				(0.002)	(0.002)	(0.002)
Anderson-Rubin Wald F Test				1.88	1.86	1.86
Observations	1,640,599	1,640,599	1,640,599	1,310,993	1,310,993	1,310,993
Controls & sample restrictions:						
Province dummies	✓	✓	✓	✓	✓	✓
Foreign dummies		✓	✓		✓	✓
State dummies		✓	✓		✓	✓
Manufacturing dummies			✓			✓

Notes: Estimates of the impact of the exposure to banks on firm's revenue, number of employee, and labor productivity. Standard errors are robust against heteroscedasticity and allow for arbitrary clustering at the firm level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level.

6 Mechanisms

6.1 Probability of getting loans

Bank expansion may go in line that firms now have broader access to more loans, including more banks, and more types of banks. Due to this, firms now can borrow more to expand their service. To test this explanation, we use probability of getting a loan to measure the accessibility of firms to credit. Particularly, we expect that men-led firms might have higher probability of getting loans with an increase in exposure to banks compared to women-led firms. If this holds true, we can confirm our explanation that women may experience more challenges in accessing to bank loans in addition to distance to banks.

The results are shown in panel A of table 6 and 7. We find that both men-led firms and women-led firms increased their probability of getting loans with an increase in exposure to banks. However, men-led firms have higher probability of getting loans compared to women-led firms. The coefficient for men-led firms is 0.013, while for women-led firms is only 0.008. It means even with similar exposure to banks, women-led firms still face more challenges in obtaining loans compared to men-led firms.

Table 6: Potential mechanisms

	Estimates for potential mechanisms (2007-2019) - Men-led firms only		
	OLS		
	(1)	(2)	(3)
Panel A. Probability of getting loans			
Exposure to banks	0.013***	0.013***	0.013***
	(0.002)	(0.002)	(0.002)
Observations	1,495,827	1,495,827	1,495,827
Panel B. Technology adoption (conditional on getting loans)			
Exposure to banks	-0.006	-0.006	-0.006
	(0.022)	(0.022)	(0.022)
Observations	1,329	1,329	1,329
Controls & sample restrictions:			
Province dummies	✓	✓	✓
Foreign dummies		✓	✓
State dummies		✓	✓
Manufacturing dummies			✓

Notes: Estimates of the impact of the exposure to banks on mend-led firm's probability of getting loans and technology adoption. Standard errors are robust against heteroscedasticity and allow for arbitrary clustering at the firm level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level.

6.2 Technology adoption

Another way for firms to improve their performance is by adopting more technology, especially automation technology. We test this explanation by running a regression similar to equation 2 where we have our main independent variable is still exposure to banks measured at year 2019,

Table 7: Potential mechanisms - Women-led firms only

	Estimates for potential mechanisms (2007-2019) - Women-led firms only		
	OLS		
	(1)	(2)	(3)
Panel A. Probability of getting loans			
Exposure to banks	0.008*	0.008*	0.008*
	(0.004)	(0.004)	(0.004)
Observations	309,999	309,999	309,999
Panel D. Technology adoption (conditional on getting loans)			
Exposure to banks	0.186***	0.186***	0.186***
	(0.051)	(0.051)	(0.051)
Observations	259	259	259
Controls & sample restrictions:			
Province dummies	✓	✓	✓
Foreign dummies		✓	✓
State dummies		✓	✓
Manufacturing dummies			✓

Notes: Estimates of the impact of the exposure to banks on women-led firm's probability of getting loans and technology adoption. Standard errors are robust against heteroscedasticity and allow for arbitrary clustering at the firm level. The coefficients with *** are significant at the 1% confidence level; with ** are significant at the 5% confidence level; and with * are significant at the 10% confidence level.

and then our main dependent variable is probability of adopting automation technology of firm i in commune c at year 2019. Because we only have questionnaires related to automation technology in year 2019, the regression in this section is at cross-section level, rather than panel data, and what we can say is more in terms of correlation than causality. In these regressions, we condition on firms getting loans to see if these firms increased their technology adoption with an increase of exposure to banks. Interestingly, we do not find a significant effect for men-led firms, but we do find that women-led firms increased their probability of adopt automation technologies. Even though the number of observations for women-led firms is only 259 (also number of unique firms), this might be an indication that women-led firms, if they get access to more loans, they will invest in newer and updated technologies, and might be a way to reduce the gender gaps in performance between women-led firms and men-led firms.

7 Conclusion

Using data for Vietnamese firms from 2007 - 2019 and newly collected data for bank information, we demonstrate that increasing exposure to banks has a positive impact on firms' revenue and number of employees, but not on firms' labor productivity. Quantitatively, we find that one unit increase in exposure to banks increased firms' sales by 2.5 - 15.3%, and number of employees by 1.0 - 5.6%. This increase in sales and number of employees is driven by men-led firms, while we do not find any effects on sales, number of employees and labor productivity for women-led firms. A potential mechanism that explain our results may be due to probability of getting loans. Men-led firms have higher probability of getting loans compared to women-led firms even with similar exposure

to banks. This indicates that women-led firms might receive implicit bias when asking for loans. Future research can discuss more in this matter, especially for in developing countries context. We also find that conditioning on getting loans, women-led firms increased their probability of adopting automation technologies, but this result is not significant for men-led firms. This might indicate that women-led firms might invest more in newer and updated technologies compared to men-led firms when receiving loans. Overall, our results highlight that in general, bank expansion helps to improve firms' sizes, but not labor productivity and this is driven by men-led firms. This suggests women-led firms may experience more challenges in addition to distance to banks, for example implicit bias in getting credit, or not enough collateral property to getting a loan. Thus, our results suggest the importance of policies in dealing with additional biases that women-led firms have to experience.

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