Female Leadership and Borrowing Constraints: Evidence from an Emerging Economy*

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Abstract

This study investigates the differences in credit access between male-managed and female-managed firms using two Enterprise Censuses in Vietnam. Our findings reveal that women-managed firms are less likely to borrow from commercial banks than their male counterparts, even when controlling for other determinants such as CEO education and experience, firm size, and ownership. No difference in credit access is documented for firms borrowing from non-commercial banks. Once we control for firm characteristics and CEO demographic factors, approved loan size is higher for firms managed by female CEOs regardless of the borrowing source. Using decomposition analysis, we find firm size contributes most in explaining the difference in credit access between female and male-managed companies.

Keywords: CEO gender, credit access, Vietnam.

JEL Classification: J16; J54; L25.

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1. Introduction

This study investigates the impact of CEO gender on company credit access in Vietnam and examines the magnitudes of various factors contributing to the differences in credit access between male-headed and female-headed companies. There has been increasing attention to gender discrimination in entrepreneurial activities. The number of male entrepreneurs is substantially higher than the number of female entrepreneurs in the world (see Estrin and Mickiewicz, 2011; Klapper and Parker, 2010). Gender discrimination can be a disadvantage for female-headed firms as the bias is toward men, who may be believed to run a business better than women. Lee and James (2007) find that shareholders respond more negatively to the appointment of a female CEO than to the appointment of a male CEO. An important mechanism for discrimination against women is the credit constraint. Women are more likely to be credit constrained than men, especially in developing countries (Khandker, 1998). Discrimination in credit happens when lenders have different views on men and women (Muravyev et al., 2009). Lenders might assess the creditworthiness of borrowers by not only their collateral and plans but also their demographic characteristics. In particular, when a lender does not have sufficient details on a borrower to estimate their ability to repay a loan, a lender might take into account information on the demographic characteristics of the borrower, such as age and gender (Arrow, 1973). Thus, if lenders have a gender bias in favor of men, they will be more likely to lend to men-owned than women-owned firms.

Empirical studies on gender discrepancy in credit access yield mixed results. Klapper and Parker (2010) review empirical evidence on the link between gender and entrepreneurship in multiple countries and document significant gender differences in the business entry: male-owned companies far outnumber firms owned by women. A number of studies find female entrepreneurs face more obstacles in obtaining credit from the formal market, or have to pay higher interest rates than their male counterparts (Muravyev et al., 2009; Alesina et al., 2013; Demirgüç-Kunt et al., 2008). Using cross-country data, Muravyev et al. (2009) find that female-owned firms are less likely to borrow from banks, and when their loan applications are approved, they incur a higher interest rate than male-owned firms. At the country level, Richardson et al. (2004) find female entrepreneurs in Africa experience difficulties in accessing formal credit; thus, they tend to rely on internal or informal sources. Alesina et al. (2013) find that women pay higher interest rates than men in Italy even after controlling for a large number of factors, such as the type of business and other characteristics of the borrower. Interestingly, Bellucci et al. (2010) find that female entrepreneurs enjoy greater credit availability in regional

areas in Italy. On the other hand, several studies find no significant effect of gender on loan access (Cavalluzzo and Wolken, 2005; Storey, 2004; Coleman, 2000). Asiedu et al. (2012) do not find any difference in credit access between firms owned by white women and white men in the United States. Cavalluzzo and Wolken (2005) find no significant gender difference in the loan denial rate among small businesses in the United States. Storey (2004) does not find any gender difference in applications or denial rates for bank loans after taking into account all other indicators of credit-worthiness. Differences in the levels of gender discrimination between countries may be explained by variations in financial development and other country-specific factors. Muravyev et al. (2009) find that gender differences in access to financing disappear in countries with high levels of financial development.

Vietnam is a developing country with a large population of 96.3 million residents, as of 2018.[6] Hence, a study of gender discrimination on firm credit access in Vietnam could shed light on understanding gender discrimination at the firm level worldwide. Although Vietnam has higher gender development indexes than other countries with similar economic development, women entrepreneurs in Vietnam still face disadvantages compared to their male counterparts due to the prevailing social and cultural gender-based inequalities and biases. [7,8] Recently, there has been an increase in the number of firms operated by women in the country; however, female-headed firms still comprise only 25 percent of the total number of firms Rastogi et al. (2017). In addition, the barriers that female entrepreneurs face in accessing formal credit is amplified by their limited access to formal education, ownership of property, and social mobility (see Barwa (2003)). A similar situation is found in other countries in South and Southeast Asia, and Africa (see Dollar and Gatti, 1999; Klasen and Lamanna, 2009; Navarro and Gallo, 2014). This article investigates the impact of CEO gender on firm credit access, taking into account differences in firm characteristics and other CEO demographic factors. The results of our analysis are highly relevant to many developing countries in Asia and Africa with a similar culture and at the same level of financial development.

[6] Vietnam is ranked 15th in the list of countries and dependencies in the world by population. Source: http://www.worldometers.info/world-population/vietnam-population/

[7] According to United Nations' Human Development Report 2007/2008, the Human Development Index (HDI) of Vietnam is ranked 105th, while the Gender-related Development Index (GDI) of Vietnam is ranked 92nd of 177 countries (United Nations, 2008).

[8] There is evidence that boys are preferred to girls in Vietnamese society. For example: Haughton and Haughton (1995) find son preference in Vietnam is stronger than the world average. Wages for women were also 17 percent lower than for men with similar education and experience (Gallup (2002)).

In addition, the borrowing market in Vietnam has a distinguishing feature compared with other countries. Traditionally, firms seek to fund their investment activities from public offering, commercial banks, and non-bank private debts, depending on their credit ratings. However, the bond market in Vietnam does not exist; hence, issuing bonds is not an option for firms operating in Vietnam. Consequently, commercial bank loans are the primary financing method for firms that meet the credit quality thresholds of commercial banks in Vietnam (Vo, 2017; Phan Quynh, forthcoming). Firms without a sufficient credit quality score mainly rely on non-commercial bank debt financing (Denis and Mihov, 2003; Kale and Meneghetti, 2011; Lin et al., 2013). Non-bank private debt, thus, plays a unique role in accommodating the financing needs of firms with credit constraints.

To the best of our knowledge, this is the first study examining the gender gap in credit access at the firm level in Vietnam. Although there are a large number of studies that examine the determinants of female entrepreneurship (e.g., Klapper and Parker, 2010; Minniti and Naudé, 2010), little is known about the determinants of access to credit for female-headed companies.[9,10] This study aims to fill in this research gap. Specifically, our study contributes to the literature in three ways. First, we provide empirical evidence about the link between gender discrimination and firm credit access in a developing, populous, and historically male-dominated country. Second, using decomposition techniques, we identify factors contributing to the gender difference in credit access between male-headed firms and female-headed firms. Finally, we examine the magnitude of each contributing factor's effect in explaining gender discrepancy in credit access. Our findings provide valuable recommendations to regulators in considering potential factors affecting female-headed firm credit access as well as information on the magnitude of these determinants when formulating anti-gender discrimination policies.

The remainder of this article proceeds as follows. Section 2 describes data sources and provides summary statistics of the credit access situation for firms according to CEO gender. Section 3 provides details of our research design and Section 4 discusses the results. Finally, Section 5 concludes.

[9] Quantitative research on the gender of firm directors in Vietnam is very limited. VCCI and ILO (2007), which looks at the female entrepreneurs of home businesses, is an exception. They find that family work and time limitations are the main difficulties for women who run a home business.

[10] A few studies examine access to finance for firms based on gender, but these studies use qualitative or theoretical analysis to address the question (see Jamali, 2009; Shaw et al., 2001; Marlow and Patton, 2005). We employ quantitative methods with real-world data to provide empirical evidence about gender discrimination.

2. Data Sources and Descriptions

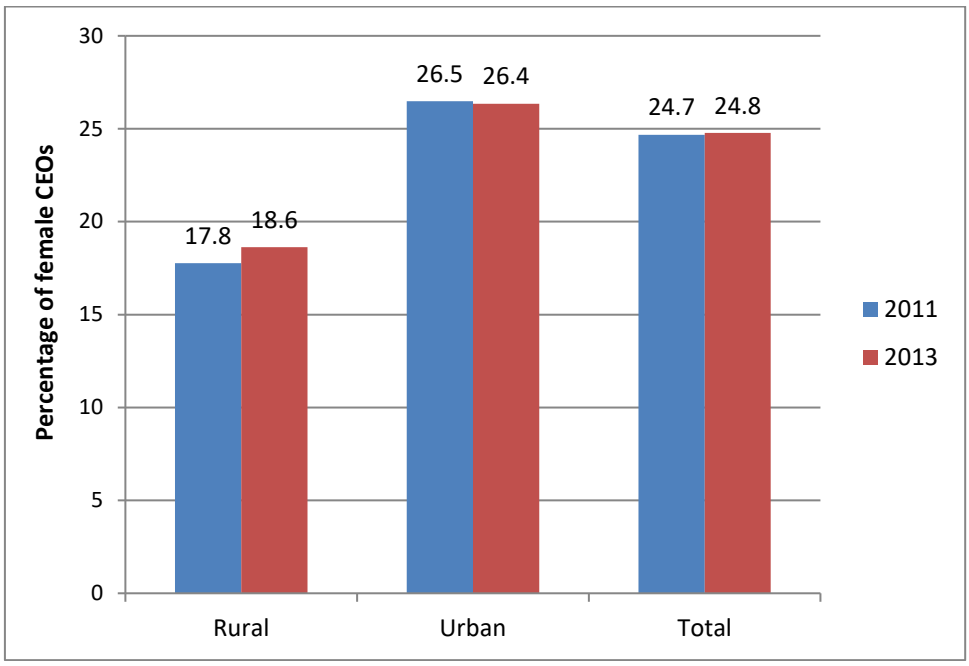
We obtain data on firms' borrowing activity, the gender of the CEOs, other CEO demographics and firm industrial characteristics from the Vietnam Enterprise Censuses (henceforth referred to as VEC) of 2011 and 2013. The census, conducted annually since 2000 by the Vietnam General Statistics Office (GSO), provides comprehensive information on firms and their activities including ownership structure, industrial sector, assets, employment, and business activities. The data were gathered through both direct and indirect channels. First, the direct data was gathered by enumerators who interviewed respondents directly to fill out the questionnaire. This method applied to firms that had not fully implemented accounting standards or that were unable to fill in the questionnaire themselves. Data were also gathered indirectly, where enumerators contacted the firm's chief accountant, general accountant or statistical staff to give instructions on how to fill in the questionnaires and how to return the form to the survey organizer (GSO, 2010).

We limited our sample to 2011 and 2013 as those surveys contained unique data on firm CEOs, including age, gender, ethnicity, and education that was not available in other surveys. The number of firms surveyed in 2011 and 2013 was 339,168 and 380,476, respectively. A subset of firms (50 percent and 15 percent in the 2011 and 2013 surveys, respectively) was randomly selected to answer additional questions if they had development investment activities within 12 months before the survey. 165,036 firms in the 2011 VEC and 50,455 firms in the 2013 VEC responded to this questionnaire. Of these, 207,853 firms reported investment activities (comprising 158,479 and 49,374 firms in the 2011 and 2013 surveys, respectively). These firms were then asked about their sources of funds and their loan sizes. This paper focuses on the ability to access external funds for development investment; thus, we limited our sample to 207,853 firms in two years. It should be noted that when pooling data of the two surveys to run regressions, we applied the sampling weight to correct for the small sample size of the 2013 data.

Figure 1 plots the distribution of firms by gender of the CEOs, which shows female-managed firms account for 24.7 percent and 24.8 percent of firms nationwide in 2011 and 2013, respectively. Our estimates are consistent with Rastogi et al. (2017) which shows that Vietnam has the highest CEO gender diversity in Southeast Asia, with 25 percent of firms having female

CEOs.[11] The proportion of firms managed by females in urban areas is much higher than that in rural areas in both years, indicating that discrimination against women in rural areas may be more severe. This finding is in line with the current literature (see, for example, Brydon and Chant, 1989 and Merrett and Gruidl, 2000).

Figure 1: Percentage of female CEOs



Source: Authors' estimation using data from the 2011 and 2013 VECs

Female CEOs also have a lower level of education compared to their male counterparts. A side-by-side comparison of education, age, and other factors between female and male CEOs in 2013 is presented in Table 1[12]. The average age of female CEOs in 2013 is 40.05 years old, two years younger than their male counterparts. Male CEOs also attain a higher education level, with 65.1 percent having completed college or university, compared to 59.3 percent of female CEOs. [13] Female-managed firms are also smaller than male-managed firms. The

[11] According to Rastogi et al. (2017), women comprise only 6%, 10% and 14% of board members at companies in Indonesia, Singapore and Malaysia, respectively. Arguably, the higher proportion of women in top positions in Vietnam is achieved due to a greater alignment between men and women in understanding the key obstacles to narrowing the gender gap in Vietnam than in the other Southeast Asian countries.

[12] A similar table for 2011 is presented in Table A.1 in the Appendix.

[13] The recent data from General Statistics Office of Vietnam shows there is no significant difference between male and female college/university enrolment and completion of tertiary degrees. This does not conflict with our study reporting a gap in the level of higher education between men and women in Vietnam because this difference can be explained by past gender inequality in education. Dang and Glewwe (2018) finds that girls' net enrolment rates were lower than those of boys by 10-15 percentage points in 1992-93, but about 10 years later, in 2004, the

average size of male-CEO businesses, measured by the number of employees, is 73.88, which is more than double the average size of female-owned businesses.

Table 1. Descriptive statistics of explanatory variables by CEO gender in 2013

Variables	Female		Male		t-statistic of differences
	Mean	Std. Dev.	Mean	Std. Dev.	
Demographic variables of CEOs					
Age of CEO	40.05	9.91	42.06	10.09	-11.63
CEO is ethnic majority (Vietnamese)	0.962	0.192	0.925	0.264	3.61
CEO is foreigner	0.010	0.100	0.055	0.227	-4.43
Technical or vocational degree	0.154	0.361	0.158	0.365	-0.47
College or university	0.593	0.491	0.651	0.477	-6.13
Urban (urban=1, rural=0)	0.830	0.376	0.751	0.432	24.68
Ownership type					
Private firms	0.181	0.385	0.153	0.360	4.51
State-owned firms	0.009	0.096	0.039	0.194	-4.77
Limited company	0.617	0.486	0.512	0.500	12.10
Joint-stock company	0.176	0.381	0.237	0.425	-22.44
FDI firms	0.017	0.130	0.059	0.236	-4.32
Industry					
Agriculture	0.015	0.122	0.037	0.190	-22.44
Mining	0.007	0.082	0.012	0.111	-12.81
Processing	0.029	0.169	0.028	0.166	1.17
Wood and paper	0.017	0.128	0.021	0.144	-6.45
Manufacturing	0.084	0.277	0.137	0.344	-9.72
Garment and textile	0.037	0.189	0.029	0.166	6.56
Construction	0.071	0.257	0.165	0.371	-37.67
Trade	0.414	0.493	0.298	0.457	37.20
Service	0.326	0.469	0.273	0.446	5.12
Size of labor force	35.75	218.00	73.88	519.47	-4.14
Number of observations	10,104		39,270		

Note: FDI stands for "foreign direct investment". The last column presents the t-statistic of the test of the equality of means between female and male CEOs.

Sources: Authors' estimation using data from the 2013 VEC.

Commercial banks have been the main credit providers in Vietnam for decades, and account for around 45 percent of total investment in the whole society with total outstanding loans of VND 4,656 trillion (equivalent to 110 percent of the country's GDP) in 2015 (Tran, 2016). In

girls' enrolment rates had almost caught up to those of boys, and from 2006 onwards the rates for girls were above those for boys at both the lower and upper secondary levels. Firm CEOs in our sample during the period of 2011 and 2013 are likely to have completed their tertiary degrees before 2004.

addition, firms might seek financial assistance from non-commercial banks, including institutional lenders – the Vietnam Bank for the Poor (VBP), the People's Credit Funds (PCFs), and Rural Shareholding Banks (RSBs) – and non-institutional sources of funds, such as money-lenders and Rotating Savings and Credit Associations (ROSCAs). Borrowing from non-commercial banks has some distinct features: (i) it focuses mostly on short-term credit for firms that are usually not able to borrow from commercial banks, and (ii) interest rates charged by these entities are generally much higher than those of commercial banks (see Bao Duong and Izumida, 2002).

Table 2 presents the proportions of firms borrowing from commercial banks and non-commercial banks.[14] As expected, borrowing from commercial banks is the most common option to finance investment projects because of the flexibility and cost efficiency. In 2011, 14.1 percent of female-managed firms borrowed from commercial banks to fund their investment projects. Borrowing from commercial banks increases in both groups during the sample period, showing the increasing financial capability of firms. In 2013, the corresponding figures for female-managed and male-managed firms are 22.0 percent and 26.6 percent, respectively.[15] The percentage of firms borrowing from non-commercial banks is also higher in male-managed firms than female-managed ones. Male-managed firms obtain remarkably larger loans than those of female-managed firms. The average loan amount per borrowing firm is VND 14,239 million for male-managed firms and only VND 6,776 million for female-managed firms.

[14] Loans from the Government are provided for a limited number of state-owned enterprises (SOEs), which are excluded from this study.

[15] Borrowing from commercial banks and non-commercial banks (in both percentage of firms and amount of loans) increased dramatically for both male and female managed firms between 2011 and 2013. This could be explained by the effectiveness of the government's macro-economic policies with the lowest inflation rate in a decade of 6.04 percent and a decrease in lending interest rates from 2011 to 2013 (GSO, 2014). In our regression, we control for year-specific effects to take into account the impact of the nationwide economic environment.

Table 2: Credit access by genders of CEOs

Variables	2011			2013		
	Female-managed firms	Male-managed firms	t-statistic of differences	Female-managed firms	Male-managed firms	t-statistic of differences
Percentage of firms borrowing from commercial banks during the last year	14.1	16.7	-11.8	22.0	26.6	-5.94
	(0.2)	(0.1)		(0.4)	(0.2)	
Percentage of firms borrowing from other sources during the last year	2.3	2.7	-2.36	3.8	5.3	-3.00
	(0.1)	(0.0)		(0.2)	(0.1)	
Amount of loans from commercial banks (million VND, computed for borrowing firms)	4,398.7	8,216.5	-8.76	6,776.4	14,239.1	-5.56
	(326.0)	(304.3)		(1003.9)	(837.1)	
Amount of loans from other sources (million VND, computed for borrowing firms)	3,079.5	5,442.0	3.49	3,754.1	5,531.9	3.75
	(515.6)	(439.5)		(817.7)	(572.3)	
Number of observations	37,970	120,509		10,105	39,269	

Note: Standard errors in parentheses. The last column presents the t-statistic of the test of the equality of means between female and male CEOs.

Sources: Authors' estimation using data from the 2011 and 2013 VECs.

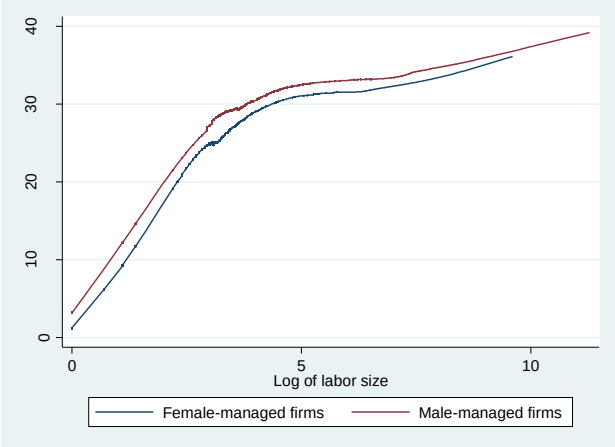
Figure 2 plots the proportion of firms with loans against the log of labor size for firms with a female CEO and those with a male CEO for the year 2013.[16,17] It shows that a lower proportion of female-managed firms have loans compared to male-managed firms across all labor sizes, regardless of the source of financing. The gender difference in the proportion of firms with loans from commercial banks is very similar across the labor size range. However, for loans from non-commercial sources, the gender difference in the proportion of firms with a loan is larger for large firms.

[16] The figure shows the results of the non-parametric regression of the proportion of firms with loans on the log of labor size for firms with a female CEO and those with a male CEO for the year 2013. We use the command 'lowess' in Stata to estimate the locally weighted scatterplot smoothed curve.

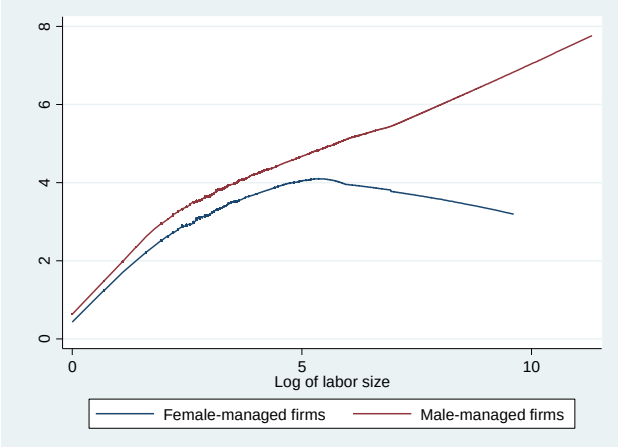
[17] The graph for 2011 is presented in Figure A.1 in the Appendix.

Figure 2: The proportion of firms with loans by CEO gender, 2013

Panel A. The proportion of firms borrowing from commercial banks



Panel B. The proportion of firms borrowing from non-commercial sources



Sources: Authors' estimation using data from the 2013 VEC.

Overall, our simple statistical summary provides evidence of a gap in credit access by CEO gender from both commercial and non-commercial sources in Vietnam. Since the literature shows that a firm's borrowing capacity and loan size are determined by other factors including firm characteristics and CEO demographics, such as level of formal education, ownership of property, and social mobility (see Barwa, 2003), we perform regression analyses to control these determinants in the following section.

3. Estimation Method

3.1. Estimation of the impact of CEO gender on credit access

In this study, we employ various regressions to examine the link between CEO gender and the firms' ability to access credit from both commercial and non-commercial banks. The firms' ability to access credit is measured by two proxies: (1) the success of getting a loan for investment projects; and (2) the size of the loans. These two proxies are used as dependent variables in the regression analyses. The former proxy is denoted by $Borrowing_{ijt}$, which equals one if the firm *i* in industry *j* borrowed from commercial banks or non-commercial banks in year *t* and equals zero otherwise. The latter is represented by $Loan_{ijt}$, which is the loan amount of firm *i* in year *t* if the firm borrowed in the year. The loan size is measured by the amount of borrowing in million VND. Since the distribution of the loan size in the sample is highly skewed to the right, we follow the current literature to transform the loan size into the

natural logarithmic form, i.e., $\log(loans)$. In our sample, around 75 percent of firms did not borrow over the last 12 months, resulting in missing values of loan size for these firms. Thus, we follow Duan et al. (1984); Manning et al. (1987); Eisenberg et al. (2015) to perform two-part model regressions that are applicable where there is a large number of zero or missing values. The two parts are a model for the binary response variable of the ability to secure a loan, $Borrowing_{it}$, and a model for the loan size variable, $Log(loan_{it})$, which is conditioned on the binary response variable. The two-part models are written as follows:

$$Borrowing_{ijt} = \alpha_D + \beta_D Female_{ijt} + \gamma_D T_t + X'_{ijt}\theta_D + u_j + \varepsilon_{ijt}, \quad (1)$$

$$Log(Loan_{ijt}) = \alpha_Y + \beta_Y Female_{ijt} + \gamma_Y T_t + X'_{ijt}\theta_Y + \eta_j + v_{ijt}$$

$$\text{for } Borrowing_{ijt} = 1 \quad (2)$$

where T_t is a time dummy indicator that equals one for 2013 and equals zero otherwise. X'_{ijt} is a vector of other control variables including CEO demographics and firm ownership types as defined in Table 1. $Log(Loan_{ijt})$ is the natural logarithm of loan value during the last twelve months. Since the logarithm only takes positive values, we estimate Equation (2) for firms with positive loans, i.e., for borrowing firms. u_j and η_j denote time-invariant unobserved variables while ε_{ijt} and v_{ijt} denote time-variant unobserved variables. The effect of CEO gender is measured by the coefficient of $Female_{ijt}$. Since gender of CEOs can be endogenous, we use industry fixed-effects specification to mitigate this endogeneity problem. Thus, we employ the probit model for Equation (1) to fit the binary dependent variable and the industry-specific effect specification (see Brooks, 2014; Antecol, 2000; Dagher and Kazimov, 2015; Mood, 2010). We use the Ordinary Least Squares (OLS) with industry-fixed effect specification for Equation (2).

In the two-part model, Equation (2) estimates the effect of the explanatory variables on the log of loan amounts conditional on positive loans, i.e., for borrowing firms. We can estimate the effects on unconditional loans by combining the coefficients from the two equations. An alternative approach is the Heckman sample selection correction model

(Heckman, 1979).[18] According to this approach, a model of loans is specified for all the firms as follows:

$$Log\left(Loan_{ijt}^{*}\right) = \alpha_Y + \beta_Y Female_{ijt} + \gamma_Y T_t + X'_{ijt}\theta_Y + \eta_j + v_{ijt}, \quad (3)$$

where $Loan_{ijt}^{*}$ is the latent loan size for all firms. This variable is observed for firms with actual loans, but unobserved for firms without actual loans. The first step of the Heckman correction model estimates Equation (1) using the probit model. Then, parameters estimated from this step are used to estimate the following model:

$$Log\left(Loan_{ijt}\right) = \alpha_Y + \beta_Y Female_{ijt} + \gamma_Y T_t + \theta_Y X'_{ijt} + \eta_j + v_{ijt} + \rho\sigma\, \varphi(Z\gamma)/\Phi(Z\gamma) + error_{ijt},$$

$$\text{for } orrowing_{ijt} = 1\ , \quad (4)$$

where ρ is the correlation between unobserved variables in Equation (1) and those in Equation (3) ($i.e., u_{ijt}$ and v_{ijt}), and σ is the standard deviation of unobserved variables in Equation (3). $\varphi(Z\gamma)/\Phi(Z\gamma)$ is the inverse Mill ratio, and $\rho\sigma$ is the coefficient of this ratio in the regression.

The Heckman correction model is more efficient if we can find at least one variable, namely an instrumental variable, that is included in the first stage probit but not in the second stage regression. However, in this study, we were unable to find such a variable. It is very difficult to find an exogenous variable that can affect the borrowing but not the loan size. Thus, the Z variables consist of the *X* variables, year dummy, and industry dummy variables. The first stage of the Heckman model is the probit regression of Equation (1).

It should be noted that in the two-part model we assume firms without borrowing can finance their projects with their own capital and have no demand for external credit. In this case, the zero loan amounts are not missing data, and they are 'true zeros'. However, if the firms without loans already applied for loans and got a rejection, the loan amounts are missing rather than 'true zeros'. In this case, the Heckman correction model would be appropriate. The datasets used in this study do not provide us with information regarding which firms applied for loans and whether they got a rejection. It is possible that some firms have no demand for

[18] This is called as Type II Tobit model in Amemiya (1984) or the probit selection model (Wooldridge, 2010)

credit and some firms applied for loans but got a rejection. Thus, in this study, we report both two-part and Heckman models.

We estimate three different specifications for each regression equation as robustness checks. The first specification (1) includes only a binary variable for the gender of the CEO and a year dummy indicator. This specification compares the outcomes between female-led and male-led firms without controlling other factors that may affect the outcomes. The second specification (2) is an extension of the first, in which we control for other characteristics of the CEO including age, age squared, ethnicity, education, and urban. These additional variables are included following the upper echelons hypothesis developed by Hambrick and Mason (1984) and Hambrick (2007), which states that firm outcomes are partially predicted by managerial background characteristics of the top level management team. Finally, the third specification (3) includes all other variables that may affect the probability to gain credit and the size of loan: for example, type of ownership, industry, and the firm size (Beck and Demirguc-Kunt, 2006 and Beck et al., 2005).[19]

3.2. Decomposition

Once we established evidence of the gender gap in credit access, we further investigated the reasons for the gap by employing the Oaxaca-Blinder decomposition technique (Oaxaca, 1973; Blinder, 1973). The firm credit ability variables are estimated separately for male- and female-managed firms:

$$Y_m = \alpha_m + X_m \beta_m + \varepsilon_m, \quad (5)$$

$$Y_f = \alpha_f + X_f \beta_f + \varepsilon_f. \quad (6)$$

[19] Both the two-part model and Hechman correction model are estimated using the Stata software. The standard errors are heteroskedasticity robust standard errors (also allowed for correlation within communes). The performance of the Heckman model depends on the availability of at least one regressor in the selection equation which is excluded from the second stage regression. As mentioned, we were not able to find an instrument for the borrowing. However, the Heckman model can be estimated since the first-stage regression is estimated by the probit model.

For simplicity, we denote the borrowing variable and loan size as *Y* without the subscript *i,t*. Subscripts '*m*' and '*f*' denote male and female CEOs, respectively.

The Oaxaca-Blinder method is widely used to decompose a gap in a dependent variable between two groups into a) a component due to differences in explanatory variables, and b) another component due to differences in coefficients of the explanatory variables (Gelbach (2016); Słoczyński (2015); Meriküll (2015)). The expected difference in *Borrowing* and *Loan size* of the two groups can be decomposed as follows:

$$\begin{aligned}\Delta E(\hat{Y}) &= \left(\hat{\alpha}_f + \bar{X}_f\hat{\beta}_f\right) - \left(\hat{\alpha}_m + \bar{X}_m\hat{\beta}_m\right) \\ &= \left[\left(\bar{X}_f - \bar{X}_m\right)\hat{\beta}^*\right] + \left[\bar{X}_f\left(\hat{\beta}_f - \hat{\beta}^*\right) + \bar{X}_m\left(\hat{\beta}^* - \hat{\beta}_m\right) + \left(\hat{\alpha}_f - \hat{\alpha}_m\right)\right],\end{aligned} \tag{7}$$

where $\hat{\alpha}$ and $\hat{\beta}$ are estimates of the parameters in Equations (5) and (6). $\bar{X}_m$ and $\bar{X}_f$ are the mean value of explanatory variables for male and female CEOs' firms, respectively. $\hat{\beta}^*$ is a vector of the estimated coefficients of the X variables from the regression using pooled data. The first term on the right-hand side, $\left(\bar{X}_f - \bar{X}_m\right)\hat{\beta}^*$, measures the gender gap in the firm outcome between female-managed and male-managed firms resulting from differences in the observed firms' characteristics. The second term represents the difference in the activities of the two groups caused by factors other than the observed characteristics of the firms. This component includes both differences in credit access to observed characteristics $\bar{X}_f\left(\hat{\beta}_f - \hat{\beta}^*\right) + \bar{X}_m\left(\hat{\beta}^* - \hat{\beta}_m\right)$ and to unobserved characteristics $\left(\hat{\alpha}_f - \hat{\alpha}_m\right)$. Hence this component is called the 'unexplained component', and it is attributed to gender discrimination.

4. Empirical Results

4.1 Borrowing from Commercial Banks

In Table 3, we report results from both the two-part model and Heckman correction model. Table 3 (left panel) reports the effects of CEO gender on the probability of borrowing from commercial banks.[20] In the first part of the two-part model, we use the probit regression. For

[20] The dependent variable in this model records if the firm had borrowing activity in the 12 months prior to the survey.

interpretation purposes, we report the marginal effects in Table 3. The original coefficients of the probit model are presented in Table A.2 in the Appendix. Specification (1) suggests that female-managed firms have a 3.04 percent lower chance of borrowing compared with their male counterparts without considering other factors that may affect borrowing capacity. When we control for other factors, the gender gap becomes smaller; however, there is still a 2.22 percent and 1.09 percent difference between male and female CEOs for specifications 2 and 3, respectively, with a lower probability for female-led firms. The lower probability of borrowing for female CEO firms could be explained by three factors including (i) female CEOs tend to be associated with less risky firms and prefer not to raise money from borrowing (Faccio et al., 2016); (ii) gender discrimination against female leadership (Dima, 2009; Nwosu and Orji, 2017); and (iii) from other determinants, which are controlled in the model and might be correlated with gender.

Table 3 (middle panel) illustrates the relationship between the gender of the CEOs and the size of loans. Only firms that borrow over the sample period are included in the regressions. Specification 1 reports that the size of loans to firms with female CEOs is 9.7 percent lower than for firms with male CEOs, which is consistent with results in Table 2.[21] When other observed variables are controlled for, the female coefficient estimations change to positive. Our estimations in specifications 2 and 3 show that female-managed firms have 4.81 percent and 15.11 percent, respectively, larger loan sizes than those managed by male CEOs with similar firm and director characteristics.[22]

The more experienced the CEOs, measured by the age of the CEO, the higher the chance that firms have access to formal credit and the larger the loans the firms can borrow (see, for example, Firth et al., 2009). The probability of borrowing and the value of loans increases with the CEO's experience and reaches its maximum value when the CEOs are 53 years old. Lower rates of borrowing for older CEOs might be explained by greater risk aversion toward older CEOs (Serfling, 2014).

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[21] The coefficient β_f represents an increase in the log of predicted counts. In Model 1, $\hat{\beta}$ equals -0.1017, then $e^{-0.1017} = 0.903$ or the size of loan for firm with female leadership is 9.7 (1-0.903 = 0.097) percent lower than that of the male CEOs.

[22] $(= e^{0.0470} - 1)$ and $(= e^{0.1407} - 1)$

International experience of the CEOs has a positive impact on firm performance as they possess valuable foreign knowledge and international networks (Le and Kroll, 2017; Houston et al., 2017). Table 3 reports that the average loan size of firms with foreign CEOs is VND 1.271 million higher than domestic CEOs.[23]

Large firms tend to have more diversified sources of capital and be less prone to bankruptcy, resulting in higher borrowing capacity (Titman and Wessels, 1988; Chen et al., 2013; Houston et al., 2017). Our estimate shows a one percent increase in the firm size (measured by the number of workers) increases the probability of borrowing and the loan size lent by commercial banks by 6.28 percent and 0.59 percent, respectively. The estimated coefficients of gender indicator in all of our regressions suggest there is taste-based discrimination on gender issue toward loan applications in commercial banks.

Results from the conditional model are similar to those from the Heckman correction model (right panel of Table 3). It should be noted that the Heckman correction model reports the coefficients in the unconditional model. Female-led firms have lower loan size than male-led firms, but once the explanatory variables are controlled for, female-lead firms are more likely to have a larger loan amounts than male-led firms.

Overall, we find that female-managed firms have a lower capability to access credit from commercial banks than male-managed firms. However, if their loan applications are approved, the loan size of firms with female CEOs is larger than that of companies with male CEOs (once the explanatory variables are controlled for).

[23] $1.271 = e^{0.2403}$

Table 3. Regression of loans from commercial banks

Explanatory variables	Borrowing from commercial banks (Marginal effects, from two-part model)			Log of loan size from commercial banks (Two-part model)			Log of loan size from commercial banks (Heckman sample selection model)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Female CEO (female=1, male=0)	-0.0304***	-0.0222***	-0.0109***	-0.1017***	0.0470**	0.1407***	-0.2949***	-0.0744**	0.1206***
	(0.003)	(0.004)	(0.004)	(0.024)	(0.020)	(0.021)	(0.037)	(0.036)	(0.026)
Age of CEO		0.0200***	0.0110***		0.0960***	0.0318***		0.2094***	0.0524***
		(0.001)	(0.002)		(0.008)	(0.008)		(0.009)	(0.007)
Squared age of CEO		-0.0002***	-0.0001***		-0.0008***	-0.0003***		-0.0019***	-0.0005***
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
CEO is ethnic majority		-0.0061	-0.0031		-0.0822	-0.1408***		-0.1184	-0.1465***
		(0.011)	(0.010)		(0.058)	(0.049)		(0.077)	(0.053)
CEO is foreigner		-0.0776***	-0.0497***		1.2104***	0.2403***		0.6508***	0.1399
		(0.006)	(0.008)		(0.182)	(0.087)		(0.235)	(0.090)
CEO with technical and vocational qualification		0.0214***	0.0150***		0.0061	-0.0530*		0.1274***	-0.0259
		(0.004)	(0.005)		(0.034)	(0.030)		(0.034)	(0.029)
CEO with college and university degree		0.0021	-0.0322***		0.6019***	0.0177		0.5761***	-0.0420*
		(0.005)	(0.004)		(0.026)	(0.022)		(0.042)	(0.025)
Urban (urban=1, rural=0)		-0.0621***	-0.0528***		-0.1300***	-0.1122***		-0.4680***	-0.2037***
		(0.008)	(0.006)		(0.046)	(0.023)		(0.040)	(0.026)
State-owned firms			-0.0693***			0.7024***			0.5507***
			(0.010)			(0.111)			(0.094)
Limited company			-0.0202***			0.2403***			0.2030***
			(0.007)			(0.026)			(0.023)
Joint-stock company			-0.0115			0.2880***			0.2648***
			(0.012)			(0.078)			(0.059)
FDI firms			-0.0943***			0.7283***			0.5038***
			(0.010)			(0.124)			(0.111)
Log of labor size			0.0628***			0.5935***			0.7063***
			(0.007)			(0.014)			(0.018)
Industries	No	No	Yes	No	No	Yes	No	No	Yes
Year dummy 2013	0.0944***	0.0809***	0.0422***	0.3402***	0.2087***	-0.0356**	0.9639***	0.6337***	0.0374
	(0.004)	(0.003)	(0.006)	(0.021)	(0.020)	(0.017)	(0.036)	(0.040)	(0.023)
Constant	0.0276***	-0.0253	-0.0344*	6.7958***	4.0326***	3.7361***	3.1944***	-1.2541***	1.9745***
	(0.001)	(0.017)	(0.019)	(0.022)	(0.209)	(0.213)	(0.086)	(0.326)	(0.324)
Rho							0.849***	0.764***	0.348***
Sigma							2.830***	2.453***	1.698***
Lambda							2.404***	1.875***	0.592***
Observations	207,853	207,853	207,853	38,178	38,178	38,178	…	38,178	38,178
R-squared	0.012	0.032	0.086	0.008	0.066	0.256			

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Authors' estimation using data from the 2011 and 2013 VECs.

4.2 Borrowing from Non-commercial Banks

Three main sources of capital for investment are commercial bank borrowing, non-bank private debt, and public offering. The main factor that determines the debt source is the credit quality of the firm. Firms with the highest credit quality may borrow from a public source, i.e., issue bonds, since they can get a low floatation cost and take advantage of information asymmetry (Hoshi et al., 1993; Denis and Mihov, 2003; Lin et al., 2013). Firms with good credit quality prefer to borrow from commercial banks to minimize the borrowing cost. The bond market in Vietnam is not well-developed, if not non-existent; hence, issuing bonds is not a practical source of capital for firms operating in Vietnam. As a result, borrowing from commercial banks is the first option for firms with good credit quality (Vo, 2017; Phan Quynh, forthcoming). Firms with a low project quality and/or high probability of bankruptcy are the most likely candidates for non-commercial bank debt financing (Denis and Mihov, 2003; Kale and Meneghetti, 2011; Lin et al., 2013).

Table 4 presents the estimates of determinants of probability to borrow (left panel) and the value of borrowing (right panels) from non-commercial banks. Marginal effects from the probit model are reported.[24] Overall, the probability of borrowing from non-commercial banks for firms with female CEOs is 0.61 percent lower than for those with male CEOs (specification 1). When the other distinctive CEO factors are considered, the gap is narrowed to 0.36 percent (specification 2). The difference in the probability of borrowing is further decreased to 0.20 percent when industry and other firm characteristics are considered.

The dissimilarity between male and female CEOs in the loan size from non-commercial banks (middle panel) reveals that female CEOs obtain larger loans compared to their male counterparts. After all other factors are considered, the size of non-commercial bank loans for firms with female CEOs is around 26.9 percent higher than for firms with male CEOs.[25] The Heckman correction models also provide a similar result.

[24] The original coefficients of the Probit model are presented in Table A.2 in Appendix.

[25] ($e^{0.2386} - 1 = 0.269$)

Table 4. Regression of loans from non-commercial banks

Explanatory variables	Borrowing from other sources (Marginal effects, from two-part model)			Log of loan size from other sources (Two-part model)			Log of loan size from other sources (Heckman sample selection model)		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Female CEO (female=1, male=0)	-0.0061***	-0.0036**	-0.0020*	-0.0474	0.1907**	0.2386***	0.0975	0.1357*	0.2226***
	(0.001)	(0.001)	(0.001)	(0.082)	(0.087)	(0.077)	(0.126)	(0.071)	(0.071)
Age of CEO		0.0022***	0.0017***		0.0533	-0.0117		0.0860***	0.0011
		(0.000)	(0.001)		(0.040)	(0.035)		(0.032)	(0.030)
Squared age of CEO		-0.0000***	-0.0000**		-0.0003	0.0002		-0.0007**	0.0000
		(0.000)	(0.000)		(0.000)	(0.000)		(0.000)	(0.000)
CEO is Kinh (Ethnic majority)		0.0086***	0.0075***		-0.0773	-0.0687		0.0670	-0.0046
		(0.003)	(0.002)		(0.208)	(0.152)		(0.188)	(0.151)
CEO is foreigner		0.0313***	0.0116***		1.5248***	0.3429*		1.8680***	0.4205**
		(0.005)	(0.004)		(0.331)	(0.201)		(0.307)	(0.203)
CEO with technical and vocational qualification		0.0026**	0.0016		0.1245	0.0655		0.1631	0.0773
		(0.001)	(0.001)		(0.102)	(0.106)		(0.101)	(0.103)
CEO with college and university degree		0.0045***	-0.0009		0.4625***	0.0721		0.5283***	0.0649
		(0.001)	(0.001)		(0.113)	(0.059)		(0.103)	(0.059)
Urban (urban=1, rural=0)		-0.0097***	-0.0109***		-0.5724***	-0.3554***		-0.7069***	-0.4319***
		(0.003)	(0.002)		(0.221)	(0.110)		(0.199)	(0.110)
State-owned firms			0.0063			-0.3837			-0.3398
			(0.012)			(0.421)			(0.342)
Limited company			0.0010			0.2826***			0.2905***
			(0.003)			(0.090)			(0.077)
Joint-stock company			0.0109*			0.1089			0.1853
			(0.006)			(0.190)			(0.151)
FDI firms			0.0168			0.6573**			0.7627***
			(0.010)			(0.322)			(0.266)
Log of labor size			0.0036*			0.6378***			0.6647***
			(0.002)			(0.018)			(0.026)
Industries	No	No	Yes	No	No	Yes	No	No	Yes
Year dummy 2013	0.0234***	0.0196***	0.0160***	-0.3574***	-0.5311***	-0.6353***	-0.8094***	-0.2776***	-0.5269***
	(0.001)	(0.001)	(0.002)	(0.064)	(0.069)	(0.079)	(0.142)	(0.096)	(0.095)
Constant				6.0425***	4.4557***	3.8270***	10.2236***	0.9029	1.9847**
				(0.067)	(1.219)	(1.090)	(0.871)	(0.927)	(0.849)
Rho							-0.628***	0.463***	0.271***
Sigma							2.894***	2.503***	2.135***
Lambda (coefficient of the inverse Mills ratio)							-1.817***	1.159***	0.579***
Observations	207,853	207,853	207,853	6,606	6,606	6,606	6,606	6,606	6,606
R-squared	0.012	0.018	0.025	0.005	0.077	0.227			

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Authors' estimation using data from the 2011 and 2013 VEC

4.3. Heterogeneous analysis

The previous section shows that female-managed firms obtain larger loans than similar male-managed firms. Once explanatory variables are controlled for, female CEOs secure a larger loan amounts than male CEOs. In this section, we examine whether the differences in the impact of CEO gender on loan size is driven by different characteristics of CEOs. Thus, we include interaction variables between female CEOs and age, ethnicity, education level of CEOs, and urban areas, respectively, to address this issue. Table 5 presents the results from Heckman correction models with interaction variables.

Table 5 shows that the effect of female CEOs on the loan size from commercial banks does not significantly differ between firms with CEOs of different ages and education. However, foreign female CEOs tend to secure a smaller loan from commercial banks compared with their male counterparts. Regarding the loans from non-commercial banks, the effect of female CEOs is not different between firms with CEOs of different ages, education, and ethnicity. The effect of female CEOs on the loan size (from non-commercial banks) is positive and significant in urban areas, but negative and insignificant in rural areas. This suggests that female CEOs obtain larger loan amounts than similar male CEOs in only urban areas.

Table 5. Heterogeneous effect of CEO gender (Heckman correction model)

	Log of loan size from commercial banks				Log of loan size from non-commercial banks			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Female CEO (female=1, male=0)	-0.2919	0.1432***	-0.0112	0.1750***	1.0621	0.2057*	0.0669	-0.0175
	(0.333)	(0.034)	(0.101)	(0.060)	(0.885)	(0.122)	(0.379)	(0.101)
Female CEO * Age of CEO	0.0198				-0.0333			
	(0.015)				(0.040)			
Female CEO * Squared age of CEO	-0.0002				0.0003			
	(0.000)				(0.000)			
Female CEO * CEO with technical and vocational qualification		0.0562				-0.2565		
		(0.054)				(0.168)		
Female CEO * CEO with college and university degree		-0.0630				0.1013		
		(0.042)				(0.198)		
Female CEO * CEO is Kinh			0.1422				0.1469	
			(0.110)				(0.366)	
Female CEO * CEO is foreigner			-0.5866**				0.5737	
			(0.241)				(0.442)	
Female CEO * Urban (urban=1, rural=0)				-0.0734				0.3172***
				(0.058)				(0.109)
Age of CEO	0.0483***	0.0527***	0.0524***	0.0526***	0.0103	0.0007	0.0011	0.0002
	(0.008)	(0.007)	(0.007)	(0.007)	(0.028)	(0.030)	(0.030)	(0.030)
Squared age of CEO	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0000	0.0000	0.0000	0.0001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
CEO is Kinh	-0.1468***	-0.1460***	-0.1854***	-0.1472***	-0.0019	-0.0114	-0.0382	-0.0103
	(0.053)	(0.053)	(0.068)	(0.053)	(0.152)	(0.152)	(0.172)	(0.151)
CEO is foreigner	0.1411	0.1339	0.1401	0.1395	0.4225**	0.4278**	0.3599	0.4145**
	(0.090)	(0.090)	(0.101)	(0.090)	(0.204)	(0.207)	(0.225)	(0.202)
CEO with technical and vocational qualification	-0.0256	-0.0361	-0.0255	-0.0246	0.0739	0.1293	0.0767	0.0687
	(0.029)	(0.035)	(0.029)	(0.029)	(0.102)	(0.101)	(0.102)	(0.102)
CEO with college and university degree	-0.0414*	-0.0285	-0.0412*	-0.0417*	0.0625	0.0421	0.0636	0.0602
	(0.025)	(0.027)	(0.025)	(0.025)	(0.059)	(0.077)	(0.059)	(0.059)
Urban (urban=1, rural=0)	-0.2037***	-0.2070***	-0.2038***	-0.1905***	-0.4295***	-0.4273***	-0.4308***	-0.4837***
	(0.026)	(0.026)	(0.026)	(0.029)	(0.110)	(0.109)	(0.110)	(0.112)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummy 2013	0.0372	0.0384	0.0371	0.0377	-0.5287***	-0.5245***	-0.5274***	-0.5245***
	(0.023)	(0.024)	(0.023)	(0.023)	(0.095)	(0.097)	(0.095)	(0.096)
Rho	0.271***	0.348***	0.355***	0.347***	0.349***	0.270***	0.271***	0.270***
Sigma	2.135***	1.697***	1.701***	1.697***	1.698***	2.134***	2.135***	2.135***
Lambda (coefficient of the inverse Mills ratio)	0.579***	0.590***	0.603***	0.589***	0.593***	0.576***	0.579***	0.577***
Constant	2.0684***	1.9402***	2.0165***	1.9624***	1.7637**	1.9868**	2.0261**	2.0598**
	(0.328)	(0.324)	(0.324)	(0.323)	(0.816)	(0.865)	(0.834)	(0.853)
Observations	207,853	207,853	207,853	207,853	207,853	207,853	207,853	207,853

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Authors' estimation using data from the 2011 and 2013 VECs.

4.4 Decomposition analysis

Male-managed firms obtain larger loans than female-managed firms; however, once the explanatory variables are controlled for, female CEOs obtain larger loans than male CEOs. This means that the differences in loan size between female- and male-managed firms are explained by the differences in explanatory variables other than the gender of the CEO. In this section, we present our estimate of the contribution of each factor on the ability to access credit by using decomposition techniques discussed in Section 3.

Table 6 reports a summary of the decomposition analysis of loans from commercial banks.[26] Detailed decomposition results for explanatory variables are presented in Table A3 in the Appendix. We conduct the decomposition analysis using the two-part model instead of the Heckman correction model, since we aim to examine both the propensity to borrow and the loan size.

The explained components, which are captured by differences in characteristics given nondiscriminatory returns, are all negative. This indicates that the differences in characteristics tend to increase the gap in firm performance between female and male directors. The proportion of male-managed firms borrowing from commercial banks was 3.36 percent higher than that of female-managed firms (see row 3 of the left panel in Table 6). The difference from observed firm characteristics explains for -0.024 differences, which is equal to 71.4 percent of the gap in the proportion of borrowing between male- and female-managed firms. The unexplained component, attributed to gender discrimination, contributes to -0.0096, which accounts for 28.6 percent of the total.

Among borrowing firms, male-managed firms also have loan sizes on average 11.85 percent larger than female-managed firms. The difference due to the explained component is -0.259, which is equal to 218.7 percent of the gender gap in loan size. A higher than 100 percent contribution of the explained component reflects the fact that male-lead firms on average have a higher probability to borrow from commercial banks; however, after taking into account other differences of the firm characteristics and the CEO demographic factors, female-managed firms have a higher probability to borrow. The estimates of differences due to the unexplained part are 0.141, which is equivalent to -118.7 percent of the total deviation suggests (see the right panel of Table 6). This indicates that the unexplained part reduces the female advantage in the loan amount by 118.7 percent.

[26] We present estimates borrowing from commercial banks since most of loans are from commercial banks. We also apply the same decomposition method for borrowing from other sources and find similar results.

In summary, we find that the gender gap in credit access is mainly caused by the differences in explained components. Next, we analyze the magnitude of the contribution of each explanatory factor to the gaps in borrowing and loan size between female-managed and male-managed firms.

Table 6. Decomposition of differences in access to loans between male- and female-CEO firms

Explanatory variables	Borrowing from commercial banks (yes=1, no=0)		Log of loan size from commercial banks	
	Mean	% of the difference	Mean	% of the difference
Firms with female CEOs	0.1579***		6.7935***	
Firms with male CEOs	0.1914***		6.9120***	
Total differences (male-female)	-0.0336***	100	-0.1185***	100
Explained components	-0.0240***	71.4	-0.2592***	218.7
Unexplained components	-0.0096***	28.6	0.1407***	-118.7
Number of observations	207,853	207,853	38,178	38,178

Note: this table reports the total difference due to explained and unexplained parts. The differences due to specific explanatory variables are reported in tables in Appendix.
*** p<0.01, ** p<0.05, * p<0.1.
% contribution of the components is equal to the percentage of the explained component or unexplained component in the total difference.
Sources: Authors' estimation using data from the 2011 and 2013 VECs.

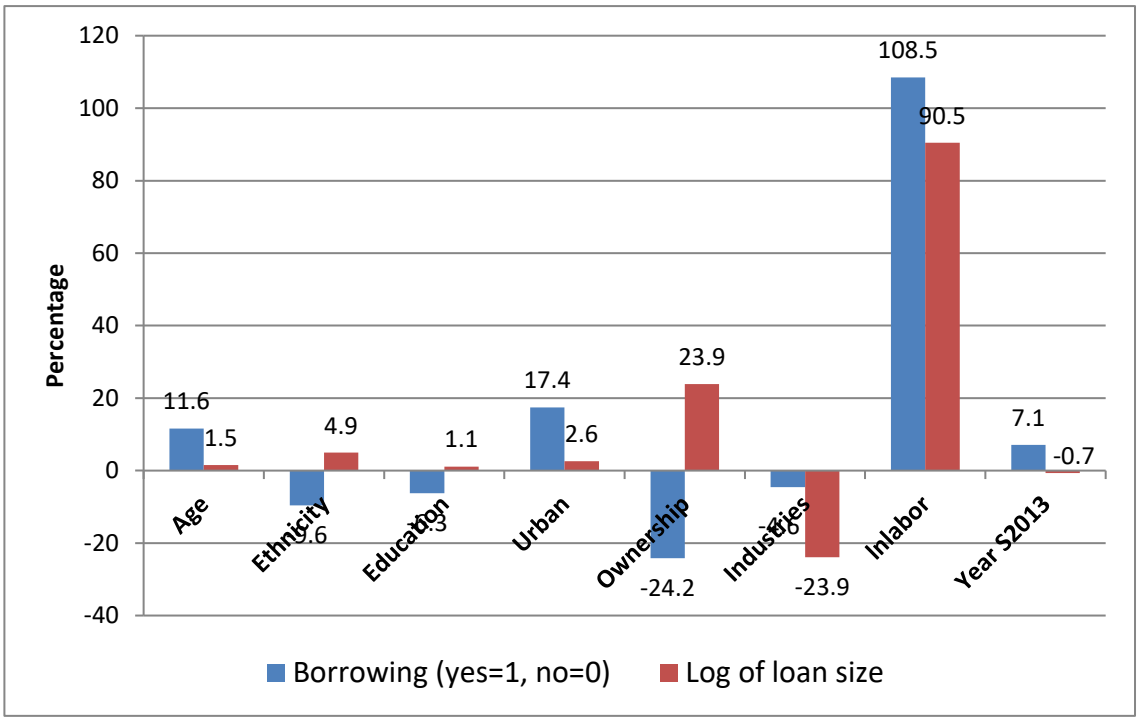
Figure 3 presents the proportion of explained variation accounted for by each explanatory variable. For presentation purposes, explanatory variables are grouped into the following categories: age, ethnicity, education, urban status, ownership, and industry. A full decomposition analysis is reported in Table A.3 in the Appendix. The parts explained by the differences in age and squared age between female CEOs and male ones are -0.0174 and 0.0146. The sum of these two parts is -0.0028, which is equal to 11.7 percent of the total explained variation, indicating that CEO age explains 11.7 percent of the difference in the probability of borrowing from commercial banks between the female-managed and male-managed firms.[27] This small and positive contribution of the difference in age could be explained by female CEOs having slightly less experience than their counterparts. Negative values of the contribution of ethnicity (-9.6 percent), education (-6.3 percent), and ownership (-24.2 percent) imply that these factors reduce the gender gap in securing loans from commercial banks.

Figure 3 shows that firm size, measured by the number of employees, is the most important factor explaining differences in credit access between female-managed and male-managed firms. This finding

[27] -0.0028 = -0.0174+0.0146 and 11.7= -0.0028/-0.024

is consistent with our earlier regression analyses. Age is more important in explaining differences in credit access between female-led and male-led firms than the other demographic characteristics.

Figure 3. Contributions of differences in explanatory variables to explained components



Sources: Authors' estimation using data from the 2011 and 2013 VECs.

5. Conclusion

This study investigates the relationship between CEO gender and firms' borrowing from commercial banks and non-commercial banks. Using a large sample of Vietnamese firms over the 2011–2013 period, we find that fewer firms with female CEOs borrow from commercial banks than companies with male counterparts. This finding holds even when we control for CEO demographic factors and other firm characteristics although the borrowing gap is narrower. We document similar effects on borrowing from non-commercial banks in specifications controlling for other CEO demographic factors. The difference in securing loans from non-commercial banks remains although the magnitude of the discrepancy reduces once we take into account the types of business, firm size, industry-specific, and time-fixed effects.

In terms of loan size, we find female CEOs are successful in obtaining larger loans than their male counterparts from both commercial and non-commercial banks. These results hold when we control for demographic characteristics, business structures, and time-specific and industry-specific effects. Using decomposition analysis, we find that the firm size, measured by the number of employees, explains

most of the variation in borrowing capacity and loan size between female-led and male-led companies. Other factors including CEO age, ethnicity and education play a less significant role in narrowing the gender gap in credit access in Vietnam.

Vietnam has a strong track record of promoting gender equality thanks to its legislation and policies in the last decade.[28] Our findings relating to the larger loan size obtained by female-led firms provide empirical evidence of the success of this legislative framework. However, according to the United Nations, the implementation of law and policy remains a challenge in Vietnam in terms of awareness raising, reporting, and other factors.[29] Our study also documented a lower probability of securing a loan for female-led firms from both commercial and non-commercial sources. This finding may indicate the existence of a gender barrier in credit access regardless of contemporary anti-gender discrimination policies. These findings suggest a need for future work to determine economic and social factors that may contribute to the gap, given that the legal regime for women's advancement and anti-discrimination is already in effect.

[28] In Vietnam, two laws aiming at promoting gender equality were passed and have been in effect for a long time: the 2006 Law on Gender Equality and the 2007 Law on the Prevention and Control of Domestic Violence.
Sources: https://www.un.org/press/en/2007/wom1593.doc.htm and
http://www.ilo.org/dyn/travail/docs/934/Law%20on%20Gender%20Equality%202006.pdf

[29] http://www.un.org.vn/en/component/content/article.html?Itemid=&id=1081:cross-cutting-themes-gender

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Appendix

Table A.1. Descriptive statistics of explanatory variables by CEO gender in 2011

Variables	Female		Male		t-statistic of differences
	Mean	Std. Dev.	Mean	Std. Dev.	
Demographic variables of CEOs					
Age of CEO	40.73	9.91	44.39	10.11	-31.3
CEO is ethnic majority (Vietnamese)	0.947	0.224	0.888	0.315	20.0
CEO is foreigner	0.031	0.173	0.088	0.283	-23.6
Technical and vocational degree	0.155	0.362	0.165	0.371	-4.7
College and university	0.635	0.481	0.643	0.479	-2.7
Urban (urban=1, rural=0)	0.784	0.411	0.722	0.448	12.6
Ownership type					
Private firms	0.157	0.364	0.167	0.373	-2.2
State-owned firms	0.023	0.149	0.062	0.242	-19.1
Limited company	0.560	0.496	0.458	0.498	17.5
Joint-stock company	0.226	0.418	0.212	0.409	2.9
FDI firms	0.033	0.180	0.101	0.301	-26.5
Industry					
Agriculture	0.030	0.170	0.040	0.196	-5.1
Mining	0.010	0.099	0.015	0.121	-3.9
Processing	0.025	0.157	0.040	0.196	-7.5
Wood, and paper	0.019	0.135	0.025	0.156	-3.8
Manufacture	0.113	0.317	0.160	0.366	-11.9
Garment and textile	0.027	0.161	0.043	0.202	-7.9
Construction	0.137	0.344	0.161	0.367	-5.7
Trade	0.360	0.480	0.212	0.409	27.0
Service	0.279	0.449	0.305	0.460	-4.8
Size of labor force	46.5	351.1	124.5	721.3	-14.2
Number of observations	37,970		120,509		

Note: The last column presents the t-statistic of the test of the equality of means between female and male CEOs.

Sources: Authors' estimation using data from the 2013 VEC.

Table A.2. First-part probit models

Explanatory variables	Borrowing from commercial sources (Marginal effects, from two-part model)			Borrowing from other sources (Marginal effects, from two-part model)		
	(1)	(2)	(3)	(1)	(2)	(3)
Female CEO (female=1, male=0)	-0.1188*** (0.011)	-0.0879*** (0.016)	-0.0451*** (0.016)	-0.0923*** (0.022)	-0.0539** (0.023)	-0.0312* (0.019)
Age of CEO		0.0773*** (0.004)	0.0447*** (0.007)		0.0323*** (0.007)	0.0251*** (0.009)
Squared age of CEO		-0.0007*** (0.000)	-0.0004*** (0.000)		-0.0003*** (0.000)	-0.0002*** (0.000)
CEO is Kinh		-0.0232 (0.042)	-0.0128 (0.040)		0.1420*** (0.048)	0.1256*** (0.042)
CEO is foreigner		-0.3529*** (0.033)	-0.2251*** (0.041)		0.3440*** (0.040)	0.1532*** (0.048)
CEO with technical and vocational qualification		0.0809*** (0.015)	0.0600*** (0.019)		0.0378** (0.019)	0.0232 (0.021)
CEO with college and university degree		0.0080 (0.020)	-0.1289*** (0.015)		0.0670*** (0.020)	-0.0138 (0.019)
Urban (urban=1, rural=0)		-0.2275*** (0.027)	-0.2040*** (0.022)		-0.1333*** (0.041)	-0.1519*** (0.027)
Private firms						
State-owned firms			-0.3327*** (0.062)			0.0871 (0.157)
Limited company			-0.0819*** (0.030)			0.0153 (0.047)
Joint-stock company			-0.0474 (0.051)			0.1511** (0.073)
FDI firms			-0.4865*** (0.073)			0.2106* (0.110)
Log of labor size			0.2561*** (0.031)			0.0537* (0.030)
Industries						
Year dummy 2013	0.3328*** (0.015)	0.2925*** (0.014)	0.1650*** (0.022)	0.2916*** (0.020)	0.2537*** (0.019)	0.2158*** (0.022)
Constant	-0.9633*** (0.015)	-2.6749*** (0.135)	-2.8842*** (0.182)	-1.9200*** (0.019)	-2.7949*** (0.191)	-2.9196*** (0.231)
Observations	207,853	207,853	207,853	6,606	6,606	6,606
R-squared	0.012	0.018	0.025	0.005	0.077	0.227

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Authors' estimation using data from the 2011 and 2013 VECs.

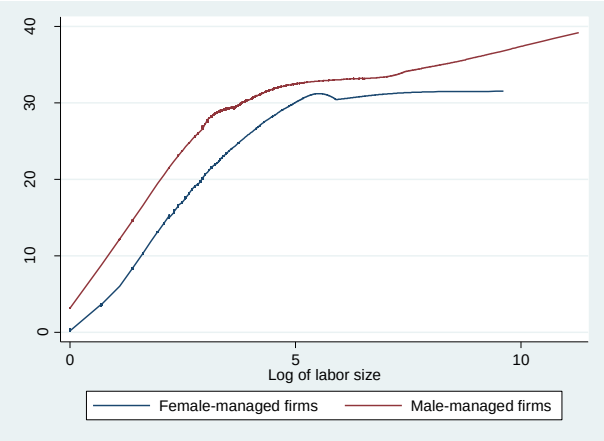
Table A.3. Decomposition of credit access

Explanatory variables	Borrowing from commercial banks (yes=1, no=0)		Log of loan size from commercial banks	
	Explained	Unexplained	Explained	Unexplained
Age of CEO	-0.0174***	0.0060	-0.0443***	0.8486
	(0.001)	(0.051)	(0.010)	(0.675)
Squared age of CEO	0.0146***	-0.0006	0.0404***	-0.4262
	(0.001)	(0.026)	(0.010)	(0.342)
CEO is ethnic minorities	Reference			
CEO is Kinh	-0.0001	-0.0136	-0.0037***	0.1533
	(0.000)	(0.012)	(0.001)	(0.105)
CEO is foreigner	0.0024***	-0.0000	-0.0091**	0.0075*
	(0.000)	(0.000)	(0.005)	(0.004)
CEO with technical and vocational qualification	-0.0001*	0.0019*	-0.0010*	0.0113
	(0.000)	(0.001)	(0.001)	(0.011)
CEO with college and university degree	0.0016***	0.0003	-0.0019	0.0178
	(0.000)	(0.003)	(0.002)	(0.027)
Urban (urban=1, rural=0)	-0.0042***	-0.0017	-0.0068***	-0.0575*
	(0.000)	(0.005)	(0.001)	(0.034)
Private firms	Reference			
State-owned firms	0.0021***	-0.0007***	-0.0338***	0.0027
	(0.000)	(0.000)	(0.003)	(0.004)
Limited company	-0.0016***	-0.0107***	0.0216***	-0.0083
	(0.000)	(0.004)	(0.003)	(0.027)
Joint-stock company	0.0004*	-0.0049***	-0.0224***	0.0045
	(0.000)	(0.001)	(0.003)	(0.014)
FDI firms	0.0049***	-0.0011**	-0.0273***	-0.0131**
	(0.000)	(0.000)	(0.004)	(0.005)
Agriculture	Reference			
Mining	-0.0013***	-0.0006**	-0.0059***	-0.0042
	(0.000)	(0.000)	(0.001)	(0.003)
Processing	0.0002	-0.0032***	0.0058***	-0.0009
	(0.000)	(0.001)	(0.002)	(0.008)
Wood, and paper	-0.0009***	-0.0024***	-0.0023**	-0.0040
	(0.000)	(0.000)	(0.001)	(0.005)
Manufacture	-0.0074***	-0.0100***	-0.0264***	0.0035
	(0.000)	(0.002)	(0.004)	(0.017)
Garment and textile	0.0004***	-0.0038***	-0.0026***	-0.0056
	(0.000)	(0.001)	(0.001)	(0.006)
Construction	-0.0132***	-0.0083***	-0.0009	0.0040
	(0.001)	(0.001)	(0.006)	(0.016)
Trade	0.0170***	-0.0409***	0.0806***	-0.0170
	(0.001)	(0.007)	(0.009)	(0.051)
Service	0.0063***	-0.0351***	0.0136***	0.0038
	(0.000)	(0.005)	(0.003)	(0.033)
Log of labor size	-0.0261***	0.0028	-0.2345***	-0.2546***
	(0.001)	(0.004)	(0.011)	(0.063)
Year 2013 (Year 2013=1; year 2011=0)	-0.0017***	-0.0043***	0.0017*	0.0077
	(0.000)	(0.001)	(0.001)	(0.013)
Constant		0.1212***		-0.1326
		(0.033)		(0.371)
Observations	207,853	207,853	38,178	38,178

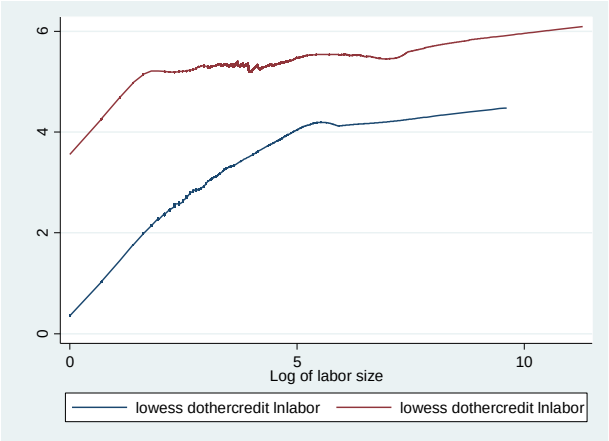
Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Sources: Authors' estimation using data from the 2011 and 2013 VECs.

Figure A.1: The proportion of firms with loans by CEO gender, 2011

Panel A. The proportion of firms borrowing from commercial banks



Panel B. The proportion of firms borrowing from non-commercial sources



Sources: Authors' estimation using data from the 2011 VEC.