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Are female CEOs more risk averse than male counterparts? Evidence from Vietnam

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ABSTRACT

In this study, we examine the differences in risk preference between male and female CEOs of firms in Vietnam. Using firm fixed-effects and instrumental variable regressions, we find that female-managed firms are less likely to operate in industries with high levels of risk. Using decomposition analysis, we find that differences due to the observed characteristics of male- and female-managed firms account for 56% of the gap in the risk index between these firms. The differences due to coefficients of the characteristics explain around 58% of the gender gap in the risk index. Among characteristics of CEOs and firms, differences in CEO age and firm ownership contribute the most to the difference in the risk index between male- and female-managed firms.

1. Introduction

Researchers have long been interested in gender differences in risk preferences. It is well documented that women are said to be more risk-averse than men (e.g., see the review by Byrnes et al., 1999; Croson and Gneezy, 2009). Croson and Gneezy (2009) summarize the related literature and provide several explanations for gender differences in risk preference, including emotions, overconfidence, and challenge taking. Women tend to experience emotions more strongly than men, and this emotion can affect risk-taking behavior. Men tend to be overconfident compared with women, and as a result are more likely to take risks. Risks may be viewed as threats or challenges and men are more likely than women to see them as challenges.

Recently, there has been increasing attention paid to gender differences in entrepreneurial activities. Over time, the number of female directors has increased, but the number of male entrepreneurs in the world remains substantially higher than the number of female entrepreneurs (Klapper and Parker, 2010). Numerous studies examine the determinants of female entrepreneurship (e.g., Klapper and Parker, 2010; Minniti and Naude, 2010) and the effect of CEO gender on firm performance (e.g., Du Rietz and Henrekson, 2000; Adams and Ferreira, 2009; Fairlie and Robb, 2009). However, there is less evidence dealing with the differences between male and female managers in risk-taking behavior. This study examines the effect of firm director gender on risk taking in Vietnam. We find robust evidence that female CEOs are more likely than male CEOs to operate in industries with lower risk.

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We expect to make several contributions to the literature on the gender differences in risk preferences. First, a large number of empirical studies have dealt with gender differences in risk-taking behavior in health, finance, insurance, lotteries, and crime (e.g., see the review by Byrnes et al., 1999; Croson and Gneezy, 2009; Maxfield et al., 2010). However, few studies discuss the risk preferences of managers, and of those that do, most focus on high-income countries. Moreover, the argument that female managers are more risk-averse than men is inconclusive. For example, Iqbal et al. (2006) and Atkinson et al. (2003) do not find a gender difference in risk attitudes, while Martin et al. (2009) and Faccio et al. (2016) find that firms with a female CEO are less likely to be exposed to idiosyncratic financial risk than firms with a male CEO. Khan and Vieito (2013) find that firms with female CEOs have a lower risk level than firms with male CEOs. Our study contributes to the literature by providing empirical findings on differences in risk preferences between male and female CEOs in Vietnam, a low middle-income country.

Secondly, most studies use experimental design to analyze gender differences and risk taking (e.g., Powell and Ansic, 1997; Eckel and Grossman, 2008; Vandegrift and Yavas, 2009). Although experimental design provides high internal validity, it may have low external validity. Participants in most experiments are often students (Croson and Gneezy, 2009). Our study estimates the gender difference in attitudes to risk, measuring this difference by the selection of the firms' main business.

Thirdly, a difficulty in measuring CEO risk preferences by gender is selection bias. The gender of CEOs is not random, and male-managed firms are different from female-managed firms, not only in observed but also unobserved characteristics. We address this problem by using firm fixed-effect regression and panel data. Fixed-effect regression addresses selection bias caused by time-invariant unobserved variables. In addition, we propose an instrument for "CEO female" and estimate the effect of CEO female on risk preference using instrumental variable regression. We estimate gender inequality using the hypothesis of the male-preferring stopping rule at the district level, and use the variation in gender inequality across districts as the instrument for female CEOs.

Fourthly, we use Oaxaca–Blinder decomposition to investigate variables that can explain the difference in risk preferences between male and female CEOs. Decomposition analysis by gender is widely applied in studies on wages and education, but to our knowledge it has not been used to analyze gender differences in attitudes to risk. By conducting the decomposition, we can provide more insight into the reasons for gender differences in risk taking.

The remainder of the paper is organized as follows. Section 2 describes the datasets used for the study. Section 3 discusses the risk levels acceptable to female CEOs as opposed to male CEOs in Vietnam. Sections 4 and 5 discuss the method and results of the decomposition analysis of risks, and Section 6 concludes the paper.

2. Dataset

The main dataset comes from the Vietnam Enterprise Censuses (VEC) in 2011 and 2013. Annually, the GSO conducts a census of all enterprises throughout the country, using their network of offices in provinces and districts. All enterprises that are registered are surveyed. The censuses cover all state enterprises, collectives, and private and foreign enterprises throughout the country. In this study, we use the 2011 and 2013 VECs, since these contain data on the chief executive officers (CEOs) of firms, including gender, age, and CEO level of education. Other censuses do not contain this information. The number of observations in VEC 2011 and VEC 2013 is 305,345 and 380,476, respectively.

The Vietnam Enterprise Censuses collect detailed information on firms' business activities and contain data common for firms in all business industries. These data include type of firm, main business industries, number of workers, number of male and female workers, number of workers with social insurance, labor costs, assets, tax, production costs, turnover and firm profit. The VECs contain data on the technology that firms currently use, e.g., the number of computers, availability of websites and internet connection, e-commerce and the application of new technology in production. Of particular interest, the VECs contain data on the age, gender, education and ethnicity of firm managers, and details concerning loans firms have obtained during the past 12 months. Data on the gender of managers are used for gender analysis of firms' credit access.

In addition to the data common to all firms, the census contains data on firms in specific business industries, such as agriculture, banking and finance, tourism and transportation. The questionnaires for these sectors are designed specifically for different business industries.

3. CEO gender and risk aversion

3.1. Risk measurement

The key objective of this study is to examine whether female CEOs are risk averse and their firms therefore less likely to operate in riskier industries and sectors. An important issue is how to measure the risk level of business industries. In this study, we will use the beta coefficient to measure the risk level of industries in Vietnam. The beta coefficient is a key component of the CAPM (capital asset pricing model), which predicts the expected return of an asset based on its beta and expected market returns. The beta coefficient is a measure of the volatility, or systematic risk, of a security or portfolio in comparison to the market as a whole. A beta of one means that a stock's volatility is the same as that of the market. A higher beta indicates more volatility, a lower beta less volatility.

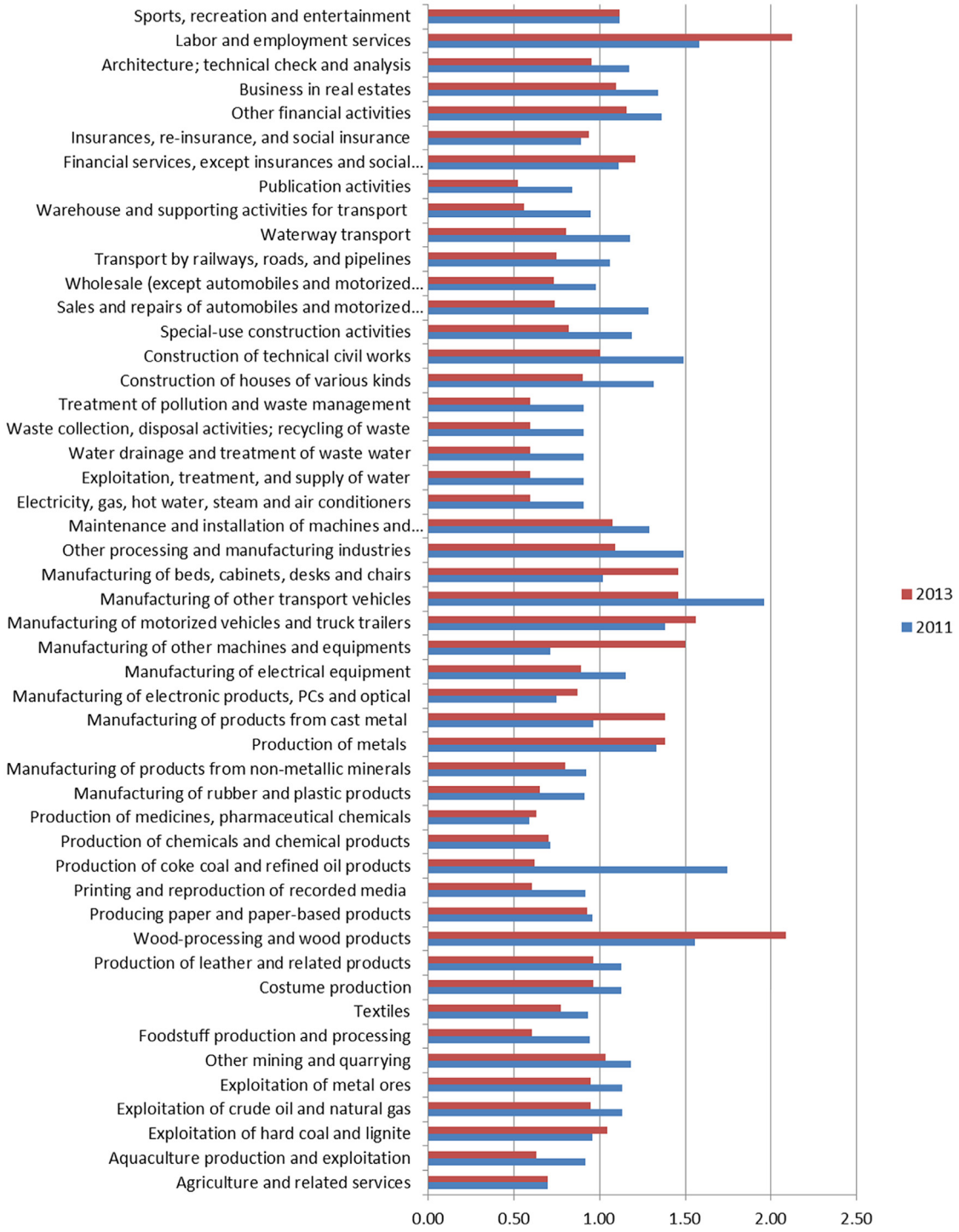

Fig. 1. Risk index of industries in Vietnam.
Source: Authors' research using data from Deposit Insurance of Vietnam.

In this study, we use the beta coefficient for industries estimated by Deposit Insurance of Vietnam (2015). The beta coefficient is estimated for two-digit SIC (Standard Industrial Classification) code industries using the Full Information Industry Betas method (Ibbotson et al., 1997; Kaplan and Peterson, 1998). The beta coefficient is estimated by regression

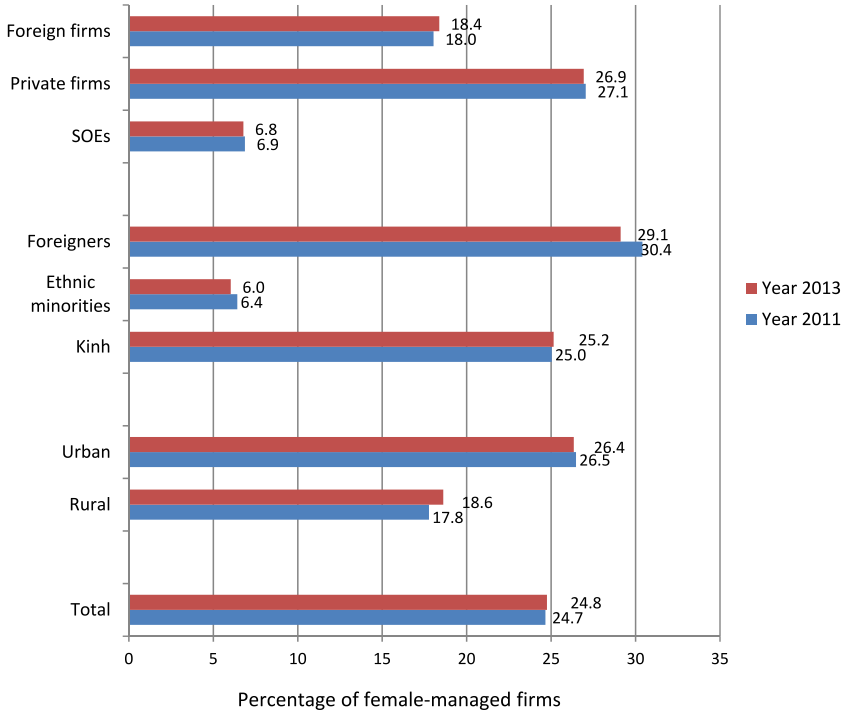

Fig. 2. Percentage of female CEOs. *Source:* Authors' estimation using data from the 2011 and 2013 VECs.

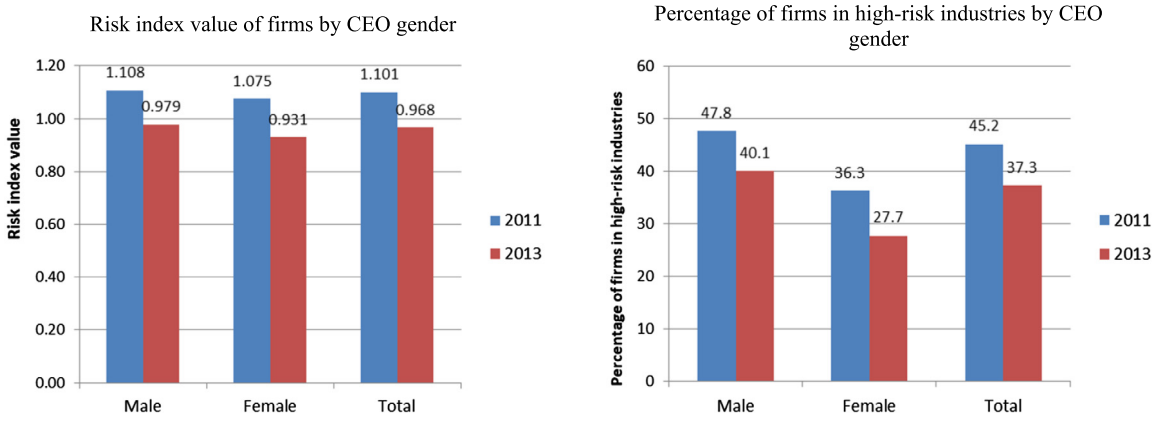

Fig. 3. Risk index of firms by CEO gender. *Source:* Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

of the individual security return on benchmark returns for different industries. A beta coefficient for industry value of less than one indicates that the industry has a lower level of risk than the average for the market. By contrast, a beta greater than one means the industry has a higher level of risk than the average. For instance, a beta of the real estate industry equals 1.5748, which means that this industry is around 57.48% riskier than the market.

Fig. 1 presents the risk index of industries in Vietnam in 2011 and 2013 using data from Deposit Insurance of Vietnam. The specific value of the risk index is presented in Table A.1 in Appendix. Fig. 1 shows that the risk index varies across industries and over time. In 2013, labor and employment services and wood processing and wood products were the riskiest industries. Publication activities, warehousing, and supporting activities for transportation were industries with the lowest level of risk.

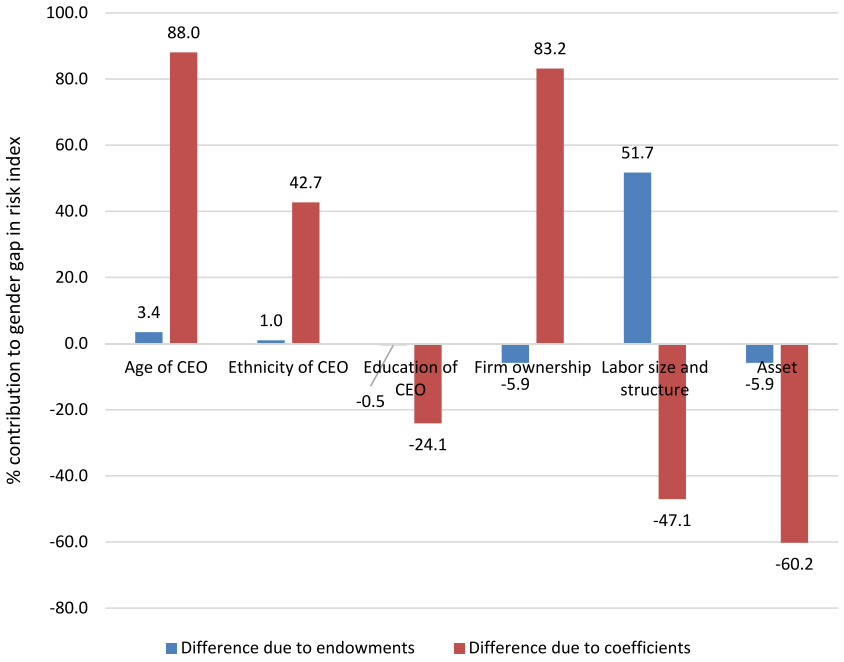

Fig. 4. Oaxaca–Blinder decomposition of risk index value using the extended model.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Table 1
Pearson correlation coefficients between the risk index and firm performance.
Source: Authors' estimation using data from the 2011 and 2013 VECs.

Variables	Log of revenue	Showing profit	Log of profit	Risk index value
Log of revenue	1			
Showing profit	0.4754*	1		
Log of profit	0.6364*	.	1	
Risk index value	−0.0264*	0.0163*	−0.0112*	1

Note: * statistically significantly different from 0 at the 5% level.

Table 1 shows a correlation between the risk index and firm performance indicators. The risk index has a negative correlation with revenue. Regarding profit, the risk index and the probability of making a profit are positively correlated. However, for firms with positive profit, the risk index is negatively correlated with the amount of profit.

3.2. CEO gender and risk aversion

Fig. 2 presents the percentage of firms with female CEOs in 2011 and 2013. The percentages in these two years are almost the same and nearly 25% of firms had a female CEO. The percentage of female-managed firms was higher in urban areas than rural ones. In 2013, the percentage of female-managed firms in rural and urban areas was 18.4% and 26.4%, respectively. This implies higher gender inequality in rural areas. The gender gap in education is also larger in rural areas than in urban ones.

Vietnam has 54 ethnic groups, of which the Kinh forms the majority group, accounting for 85% of the total population. The Kinh have higher living standards and are more concentrated in the delta and urban areas. Ethnic minorities are more likely to live in the mountains and highland regions. Fig. 2 shows that the percentage of female-managed firms is higher among foreign and Kinh CEOs than among ethnic minority CEOs. This implies a negative correlation between the proportion of female-managed firms and gender inequality.

It shows that the proportion of female-managed firms depends on the firm ownership. The percentage of female-managed firms is lowest in the State-owned enterprises (SOE) and highest for the private firms. In 2013, the percentage of female-managed firms was 6.9% among SOEs, 18.0% among foreign firms and 27.1% among the domestic private firms. One reason why the percentage of female CEOs in SOEs is low is that the retirement age of women is lower than men (55 for women and 60 for men). CEOs of SOEs are public staffs and follow the retirement age applied for civil servants.

To examine the risk index and gender of CEOs, we merge firm-level data from the 2011 and 2013 VECs with the industry-level risk data. In other words, for each firm in the 2011 and 2013 VECs, there is information on the two-digit

Table 2
Risk and gender of CEOs in 2011 and 2013.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Demographic characteristics of CEOs	Risk index of industries in which firms operate			Percentage of firms in industries with risk index higher than one		
	Male	Female	Total	Male	Female	Total
Ethnicity of CEO						
Kinh	1.04	1.00	1.03	43.7	31.7	41.0
Foreigner	1.08	1.07	1.08	50.5	49.4	50.4
Ethnic minority	1.01	1.00	1.00	34.5	29.8	33.1
Age of CEO						
Less than 25	1.02	0.99	1.01	34.6	29.0	32.3
25–34	1.03	0.99	1.02	41.6	29.9	38.4
35–44	1.05	1.00	1.04	44.9	32.4	42.1
45–54	1.04	1.00	1.04	44.1	32.6	41.9
55–64	1.03	1.00	1.02	43.6	33.8	41.9
65+	1.04	0.98	1.03	45.6	31.1	43.4
Education of CEO						
No technical or vocational degree	1.03	1.01	1.03	37.6	30.1	35.8
Technical or vocational degree	1.03	1.00	1.03	43.3	32.7	41.0
College or university	1.04	1.00	1.03	45.8	32.1	42.8
Total	1.04	1.00	1.03	43.7	31.7	41.0

SIC (Standard Industrial Classification) codes of its main business industry, and we add the value of the risk level of the corresponding industry to the firm. The left panel of Fig. 3 presents the average risk index (i.e., the beta coefficient) of firms in 2011 and 2013. The risk levels were 1.10 and 0.97 in 2011 and 2013, respectively. The average risk index of firms with female CEOs is lower than that of firms with male CEOs. In 2013, the risk index of firms with male CEOs and those with female CEOs was 0.98 and 0.93, respectively. We conducted a t-statistics test, and the results suggest that the null hypothesis of the equality of the mean of the risk index between firms with female CEOs and firms with male CEO is strongly negated. Later analysis using regression yields similar evidence that female CEOs are more risk averse than their male counterparts.

In the right panel of Fig. 3, we estimate the percentage of firms operating in an industry with beta coefficients higher than one. Industries with a beta coefficient greater than one are considered to be riskier firms (high risk). The percentage of firms operating in high risk industries decreased from 45.2% in 2011 to 37.3% in 2013. There was a large gap in the percentage of firms in high risk industries between firms with female CEOs and those with male CEOs. In 2013, 40.1% of firms with male CEOs operated in high risk industries, while this figure was only 27.7% for firms with female CEOs.

In Table 2, we pool data from both the 2011 and the 2013 VECs to estimate the risk index and the percentage of firms in high risk industries for different groups of firms with different CEO characteristics. Firms with foreign CEOs are more likely to do business in high-risk industries than firms with Kinh CEOs. There is a correlation between risk and CEO age and education, especially for male CEOs. Young, less educated male CEOs tend to operate in less risky industries than older, better educated male CEOs. For female CEOs, the correlation between age, education and the risk level of an industry tends to be smaller.

4. Estimation method

4.1. The effect of CEO gender on the risk index

To examine whether firms with female CEOs tend to operate in low-risk industries, we will apply the following econometric model:

$$Y_{i,j,t} = \beta_0 + Female_{i,j,t}\beta_1 + X_{i,j,t}\beta_2 + T_t\beta_3 + u_{i,j} + v_{i,j,t}, \quad (1)$$

where $Y_{i,j,t}$ is an indicator of the risk level of industry j, in which firm i operates in the year t. $Female_{i,j,t}$ is a dummy variable indicating whether the CEO of the firm is female (female = 1, male = 0). The control variables, X, include CEO and firm characteristics. T_t is the time variable, which is equal to 1 for the 2013 VEC and 0 for the 2011 VEC. $u_{i,j}$ and $v_{i,j,t}$ represent time-invariant and time-variant unobserved variables, respectively. The gender gap in risk aversion is measured by the coefficient of $Female_{i,j,t}$.

A problem is that CEO gender is not exogenous. Compared with male-managed firms, female-managed firms may differ not only in observed characteristics, such as labor and capital, but also in unobserved characteristics, such as network. There may also be prejudice against women. To address the selection bias, we can use firm fixed-effects regression, which has the advantage that it eliminates the time-invariant unobserved variables $u_{i,j}$ (Wooldridge, 2010). Important, unobserved, time-invariant variables, such as culture and geographic variables that can affect both risk aversion and prejudices against women, are removed from the fixed-effects regression.

Table 3
Firm fixed-effects regressions of risk index and operating in high-risk industries.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Risk index of industry		Firms in industries with risk index above one (yes=1, no=0)	
	Parsimonious model	Extended model	Parsimonious model	Extended model
Female CEO (female=1, male=0)	−0.0348***	−0.0242***	−0.0965***	−0.0661***
	(0.0011)	(0.0011)	(0.0022)	(0.0022)
Age of CEO	0.0025***	0.0023***	0.0070***	0.0066***
	(0.0003)	(0.0003)	(0.0006)	(0.0006)
Squared age of CEO	−0.0000***	−0.00003***	−0.0001***	−0.0001***
	(0.0000)	(0.00001)	(0.0000)	(0.0000)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0209***	0.0118***	0.0412***	0.0254***
	(0.0029)	(0.0029)	(0.0051)	(0.0050)
Foreign CEO	0.0582***	0.0109*	0.0977***	0.0087
	(0.0043)	(0.0060)	(0.0074)	(0.0103)
CEO has technical or vocational degree	0.0014	−0.0008	0.0416***	0.0372***
	(0.0014)	(0.0014)	(0.0024)	(0.0024)
CEO has college or university degree	0.0096***	−0.0021*	0.0517***	0.0272***
	(0.0012)	(0.0012)	(0.0021)	(0.0021)
Urban dummy (urban=1, rural=0)	0.0053***	0.0002	0.0241***	0.0185***
	(0.0014)	(0.0014)	(0.0024)	(0.0025)
Firm is a private enterprise	Reference			
Firm is a state-owned enterprise		0.0105**		0.0013
		(0.0044)		(0.0078)
Firm is a limited company		0.0427***		0.0673***
		(0.0017)		(0.0030)
Firm is a joint-stock company		0.0629***		0.1594***
		(0.0019)		(0.0035)
Firm is an FDI company		0.0833***		0.1465***
		(0.0057)		(0.0100)
Log of labor size		0.0177***		0.0463***
		(0.0005)		(0.0008)
Proportion of female workers		−0.0575***		−0.1684***
		(0.0020)		(0.0035)
Proportion of social insurance workers		−0.0331***		−0.0267***
		(0.0013)		(0.0024)
Log of total assets		0.0022***		0.0023***
		(0.0004)		(0.0006)
Proportion of owned equity in total capital		0.0174***		0.0979***
		(0.0015)		(0.0027)
Proportion of fixed assets in total capital		−0.0413***		−0.0838***
		(0.0020)		(0.0035)
Dummy year 2013	−0.1257***	−0.1186***	−0.0737***	−0.0535***
	(0.0006)	(0.0007)	(0.0010)	(0.0012)
Constant	1.0189***	0.9612***	0.2096***	0.0550***
	(0.0079)	(0.0084)	(0.0153)	(0.0159)
Observations	381184	381184	381184	381184
R-squared	0.17	0.16	0.02	0.02

Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Fixed-effects regression may not fully address selection bias. Thus, we also use instrumental variable regression, which requires an instrument which is strongly correlated with an endogenous explanatory variable but not with the error terms in the equation, including the dependent variables. Finding such a valid instrument is very challenging. In this study, we find an instrument which measures the gender inequality in local areas. Compared to other countries with similar economic development, Vietnam has higher gender development indexes (United Nations, 2008). Females are more likely to be enrolled in high schools and universities than males. Nevertheless, gender inequality in perception remains a problem in Vietnam. People prefer boys to girls (Guilmoto, 2012). Nguyen and Tran (2017) find that families tend to continue having children until they get a boy. The male-preferring stopping rule (Yamaguchi, 1989) suggests a way to measure prejudice against women. Specifically, using the 2009 Population and Housing Census we first estimate the effect of a female first-born on the number of children. On average, if the first-born is a girl, the number of children increases by 20%. This means that families tend to have more children if the first-born child is a girl. Put differently, a male first-born reduces the number of children. A positive, significant effect implies bias against women. We estimate this effect for all districts in Vietnam. The coefficient of the first-born girl is positive in 97% of districts, and significant at the 10% level in 82% of the districts (Fig. A.1 in the Appendix). Only 3% of districts have a negative coefficient for the first-born girl. This suggests gender inequality in most districts throughout Vietnam.

Table 4
2SLS regressions of risk index and operating in high risk industries in 2013.
Source: Authors' estimation using data from the 2013 VEC and Deposit Insurance of Vietnam.

Explanatory variables	First-stage regression		Second-stage regression			
	Dependent variable: Dummy of female-managed firm		Dependent variable: Risk index of industry		Dependent variable: Risk index above one (yes=1, no=0)	
	Parsimonious model	Extended model	Parsimonious model	Extended model	Parsimonious model	Extended model
Instrumental variable	−0.4531***	−0.4331***				
	(0.011)	(0.011)				
Female CEO (female=1, male=0)			−0.2244***	−0.1768***	−0.7701***	−0.5214***
			(0.015)	(0.015)	(0.036)	(0.036)
Age of CEO	−0.0107***	−0.0059***	0.0026***	0.0034***	0.0048***	0.0081***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)
Squared age of CEO	0.0001***	0.0000***	−0.0000***	−0.0000***	−0.0001***	−0.0001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	−0.0521***	−0.0311***	0.0167***	0.0057**	0.0437***	0.0354***
	(0.006)	(0.005)	(0.003)	(0.003)	(0.008)	(0.007)
Foreign CEO	−0.1900***	−0.2135***	−0.0338***	−0.0383***	−0.0540***	−0.0777***
	(0.006)	(0.010)	(0.005)	(0.007)	(0.012)	(0.016)
CEO has technical or vocational degree	−0.0606***	−0.0478***	−0.0059***	−0.0016	0.0174***	0.0291***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.004)	(0.004)
CEO has college or university degree	−0.0704***	−0.0529***	0.0097***	−0.0026*	0.0051	0.0021
	(0.002)	(0.002)	(0.002)	(0.001)	(0.004)	(0.003)
Urban dummy (urban=1, Rural=0)	0.0470***	0.0280***	0.0528***	0.0376***	0.1024***	0.0925***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.004)	(0.003)
Firm is a private enterprise	Reference					
Firm is a state-owned enterprise		−0.1407***		−0.0013		−0.1033***
		(0.005)		(0.005)		(0.010)
Firm is a limited company		−0.0300***		0.0472***		0.0606***
		(0.003)		(0.001)		(0.004)
Firm is a joint-stock company		−0.0880***		0.0693***		0.1252***
		(0.003)		(0.002)		(0.005)
Firm is an FDI company		−0.0695***		0.0416***		0.0873***
		(0.009)		(0.005)		(0.012)
Log of labor size		−0.0131***		0.0143***		0.0591***
		(0.001)		(0.001)		(0.001)
Proportion of female workers		0.5840***		0.0111		0.0267
		(0.003)		(0.009)		(0.021)
Proportion of social insurance workers		−0.0306***		−0.0602***		−0.1157***
		(0.003)		(0.001)		(0.003)
Log of total assets		0.0048***		0.0071***		−0.0008
		(0.001)		(0.000)		(0.001)
Proportion of owned equity in total capital		−0.0444***		0.0079***		0.0874***
		(0.003)		(0.001)		(0.004)
Proportion of fixed assets in total capital		0.0230***		−0.0785***		0.0159***
		(0.004)		(0.002)		(0.005)
Constant	0.6344***	0.3712***	1.0510***	0.9203***	0.4146***	0.0614***
	(0.015)	(0.015)	(0.012)	(0.009)	(0.029)	(0.022)
Observations	246,588	246,588	246,588	246,588	246,588	246,588
R-squared	0.028	0.144	−0.128	−0.028	−0.281	−0.073
Weak identification test						
Cragg-Donald Wald F statistic	2791	1426				
Kleibergen-Paap rk Wald F statistic	3523	1621				

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Cragg-Donald Wald F statistic and Kleibergen-Paap rk Wald *F* statistic are test statistics of weak instruments. As a general rule, if an *F*- statistic is under 10, the instruments may be weak (Staiger and Stock, 1997).

Table 5
The effect of female CEOs on risk variables.
Source: Authors' estimation using data from the 2013 VEC and Deposit Insurance of Vietnam.

Models	Dependent variable: Risk index of industry			Dependent variable: Risk index above one (yes=1, no=0)		
	Sample of state-owned enterprise	Sample of private firms	Sample of firms with foreign investment	Sample of state-owned enterprise	Sample of private firms	Sample of firms with foreign investment
Firm fixed-effect regression (using panel data the 2011 and 2013 VECs)	−0.0194 (0.015)	−0.0252*** (0.001)	−0.0257*** (0.002)	−0.0247 (0.023)	−0.0635*** (0.002)	−0.0817*** (0.005)
2SLS regression (using data from the 2013 VEC)	0.1244 (0.075)	−0.1117*** (0.015)	−0.6313*** (0.080)	0.0123 (0.052)	−0.4294*** (0.034)	−1.1850*** (0.164)

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.
Cragg-Donald Wald F statistic and Kleibergen-Paap rk Wald F statistic are test statistics of weak instruments. As a general rule, if an F- statistic is under 10, the instruments may be weak (Staiger and Stock, 1997).

In this study, we use the coefficient of the first-born girl at the district level as the instrument for CEO gender. We find a strong negative correlation between the effect of first-born girls on the number of children and the percentage of female CEOs. Districts with more gender inequality have a lower percentage of female CEOs. We assume that district-level gender inequality does not affect the performance of specific firms.

4.2. Decomposition analysis

We use the well-known Oaxaca–Blinder decomposition technique (Blinder, 1973; Oaxaca, 1973) to examine factors that can explain the difference in the risk index between male and female CEOs. Firstly, we run separate OLS regressions of the risk index for male and female CEOs as follows:

$$Y_f = \alpha_f + X_f\beta_f + u_f, \tag{2}$$

$$Y_m = \alpha_m + X_m\beta_m + u_m. \tag{3}$$

Subscripts '*f*' and '*m*' denote female- and male-managed firms, respectively. The model specifications are similar to model (1). For simplicity, subscripts *i, j,* and *t* are dropped.

The Oaxaca–Blinder decomposition is used to decompose gaps in the dependent variable between two groups into a gap due to differences in the explanatory variables, and a gap due to differences in the coefficients of the explanatory variables. The decomposition is expressed as follows:

$$\begin{aligned}\Delta\hat{E}[Y] &= \hat{E}\left[Y_f\right] - \hat{E}\left[Y_m\right] \\ &= \left(\hat{\alpha}_f + \overline{X}_f\hat{\beta}_f\right) - \left(\hat{\alpha}_m + \overline{X}_m\hat{\beta}_m\right) \\ &= \left(\overline{X}_f - \overline{X}_m\right)\hat{\beta}_m + \left[\left(\hat{\beta}_f - \hat{\beta}_m\right)\overline{X}_m + \left(\hat{\alpha}_f - \hat{\alpha}_m\right)\right] + \left(\overline{X}_f - \overline{X}_m\right)\left(\hat{\beta}_f - \hat{\beta}_m\right),\end{aligned} \tag{4}$$

where $\hat{\alpha}$ and $\hat{\beta}$ are estimators of the parameters in regressions (2) and (3). $\overline{X}_f$ and $\overline{X}_m$ are the average of the explanatory variables for firms with female CEOs and those with male CEOs, respectively.

The first term in Eq. (4) is the gap in the risk index between male and female CEOs, resulting from the differences in CEO and firm characteristics. This is described as the endowment effect. The second term is the difference in the risk level due to differences in the coefficients of the explanatory variables in the regression models. This can be explained as the difference arising from the gap in the effect of characteristics on the risk index between firms with female CEOs and those with male CEOs. The third term is an interaction term accounting for the simultaneous existence of differences in endowments and the coefficients of the two groups. Note that the decomposition in (4) represents the perspective of firms with female CEOs (Jann, 2008).

It should be noted that we use the OLS regression instead of firm fixed-effects regression to estimate model (2) and (3) for the decomposition analysis, since Heitmueller (2005) shows that the Oaxaca–Blinder decomposition can be biased in the fixed-effects regressions including time invariant regressors omitted variables.

It should be note that there is an index problem with the Oaxaca–Blinder decomposition method: the choice of the reference group (female and male CEOs) affect the results of decomposition analysis. In this study, we tried decomposition using the reference of both male and female CEOs. The results are quite similar. For simplicity and avoidance of overlapped interpretation, CEOs we report results using the female CEOs as the reference group. This makes the interpretation from the perspective of female CEO groups.

Table 6
Oaxaca–Blinder decomposition of risk index value using the extended model.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Risk index of industry		
	Endowments	Coefficients	Interaction
Age of CEO	−0.0080***	−0.0555**	0.0026**
	(0.001)	(0.025)	(0.001)
Squared age of CEO	0.0066***	0.0194	−0.0018
	(0.001)	(0.013)	(0.001)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0003***	−0.0173***	−0.0003***
	(0.000)	(0.004)	(0.000)
Foreign CEO	−0.0007***	−0.0002	0.0001
	(0.000)	(0.000)	(0.000)
CEO has technical or vocational degree	0.0000	0.0022***	−0.0001***
	(0.000)	(0.000)	(0.000)
CEO has college or university degree	0.0002***	0.0077***	−0.0003***
	(0.000)	(0.001)	(0.000)
Urban dummy (urban=1, rural=0)	−0.0002***	−0.0114***	−0.0012***
	(0.000)	(0.002)	(0.000)
Firm is a private enterprise	Reference		
Firm is a state-owned enterprise	−0.0003***	−0.0011***	0.0009***
	(0.000)	(0.000)	(0.000)
Firm is a limited company	0.0051***	−0.0312***	−0.0056***
	(0.000)	(0.001)	(0.000)
Firm is a joint-stock company	−0.0039***	−0.0116***	0.0028***
	(0.000)	(0.001)	(0.000)
Firm is an FDI company	−0.0024***	−0.0018***	0.0013***
	(0.000)	(0.000)	(0.000)
Log of labor size	−0.0062***	−0.0091***	0.0011***
	(0.000)	(0.002)	(0.000)
Proportion of female workers	−0.0148***	0.0228***	0.0095***
	(0.000)	(0.001)	(0.000)
Proportion of social insurance workers	−0.0002***	0.0056***	0.0001***
	(0.000)	(0.001)	(0.000)
Log of total assets	−0.0002***	−0.0128**	0.0002**
	(0.000)	(0.005)	(0.000)
Proportion of owned equity in total capital	−0.0003***	0.0240***	−0.0011***
	(0.000)	(0.002)	(0.000)
Proportion of fixed assets in total capital	0.0029***	0.0135***	−0.0024***
	(0.000)	(0.001)	(0.000)
Dummy of the 2013 year	−0.0004**	−0.0094***	−0.0001**
	(0.000)	(0.001)	(0.000)
Overall difference			
Firms with female CEO	0.9988***		
	(0.001)		
Firms with male CEO	1.0398***		
	(0.000)		
Total absolute difference	−0.0410***		
	(0.001)		
Difference due to endowments	−0.0227***		
	(0.000)		
Difference due to coefficients	−0.0241***		
	(0.001)		
Difference due to interaction	0.0059***		
	(0.001)		
Constant		0.0420***	
		(0.014)	

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

5. Empirical results

5.1. The effect of CEO gender on the risk index

In this section, we present the regression and decomposition analysis of the risk and gender of CEOs. We regress the risk index of industries in which firms operate on the gender of CEOs using data from the 2011 and 2013 VECs. There are two independent variables, including the risk index level and the dummy indicating whether the risk index level for industries is larger than one. For each dependent variable, there are two model specifications which differ in the set of the control variables. The parsimonious model includes the demographic variables of CEOs, including age, ethnicity, education

Table A.1
Risk indexes of industries in Vietnam.
Source: Deposit Insurance of Vietnam.

Industries	2011	2013
Agriculture and related services	0.70	0.70
Aquaculture production and exploitation	0.92	0.63
Exploitation of hard coal and lignite	0.96	1.05
Exploitation of crude oil and natural gas	1.13	0.95
Exploitation of metal ore	1.13	0.95
Other mining and quarrying	1.19	1.04
Foodstuff production and processing	0.94	0.61
Textiles	0.93	0.77
Costume production	1.13	0.96
Production of leather and related products	1.13	0.96
Wood-processing and wood products	1.56	2.09
Producing paper and paper-based products	0.96	0.93
Printing and reproduction of recorded media	0.92	0.61
Production of coal and refined oil products	1.75	0.62
Production of chemicals and chemical products	0.71	0.70
Production of medicines, pharmaceutical chemicals	0.59	0.63
Manufacturing of rubber and plastic products	0.91	0.65
Manufacturing of products from non-metallic minerals	0.92	0.80
Production of metals	1.33	1.38
Manufacture of products from cast metal	0.96	1.38
Manufacture of electronic products, PCs and optical	0.75	0.87
Manufacture of electrical equipment	1.15	0.89
Manufacture of other machines and equipment	0.71	1.50
Manufacture of motorized vehicles and truck trailers	1.38	1.56
Manufacture of other transport vehicles	1.96	1.46
Manufacture of beds, cabinets, desks and chairs	1.02	1.46
Other processing and manufacturing industries	1.49	1.09
Maintenance and installation of machines and equipment	1.29	1.08
Electricity, gas, hot water, steam and air conditioning	0.91	0.60
Exploitation, treatment, and supply of water	0.91	0.60
Water drainage and treatment of waste water	0.91	0.60
Waste collection, disposal activities; recycling of waste	0.91	0.60
Treatment of pollution and waste management	0.91	0.60
Construction of houses of various kinds	1.32	0.90
Construction of technical civil works	1.49	1.01
Special-use construction activities	1.19	0.82
Sales and repairs of automobiles and motorized vehicles	1.28	0.74
Wholesale (except automobiles and motorized vehicles)	0.98	0.73
Transport by railways, roads, and pipelines	1.06	0.75
Waterway transport	1.18	0.80
Warehousing and supporting activities for transport	0.95	0.56
Publication activities	0.84	0.53
Financial services, except insurance and social insurance	1.11	1.21
Insurance, re-insurance, and social insurance	0.89	0.94
Other financial activities	1.36	1.16
Business in real estate	1.34	1.10
Architecture; technical check and analysis	1.17	0.95
Labor and employment services	1.58	2.13
Sports, recreation and entertainment	1.12	1.12

and urban area as the control variables. In the extended model, additional variables are types of firm ownership, labor size, fixed assets and firm equity. Although these variables are endogenous, controlling for them allows us to examine whether they can explain the gender difference in the risk index. The summary statistics of variables are presented in Table A.2 in Appendix.

We begin with ordinary least squares (OLS) regression and pooled data from the 2011 and 2013 VECs as a starting model of association. The results are reported in Table A.3 in Appendix. It shows that there is a significant correlation between CEO gender and the risk level of the business industries of firms. Female-managed firms are more likely to operate in lower risk industries. Table 3 presents the fixed-effects regressions. It also shows that firms with female CEOs have a lower risk index than do firms with male CEOs. The coefficient of female CEOs is negative and significant at less than a 1% level. In the parsimonious model, the estimate of this coefficient is equal to −0.0348. This means that on average, industries operated by firms with female CEOs are 3.5% less risky than industries operated by firms with male CEOs. When additional explanatory variables are controlled for, the coefficients of female CEOs decrease slightly to −0.0242 but are still statistically very significant.

It should be noted that when dependent variables are binary, probit or logit models should be used. However, fixed-effects probit models are available due to the problem of incidental parameters (Greene, 2004). Although a fixed-effects

Table A.2
Summary statistics of variables.
Source: Authors' estimation using data from the 2011 and 2013 VECs.

Variables	2011		2013	
	Mean	Std. Dev.	Mean	Std. Dev.
Log of turnover	7.121	3.057	6.834	3.332
Firm making profit (yes=1, no=0)	0.563	0.496	0.520	0.500
Log of profit	3.925	2.081	3.996	2.131
Risk index of industry	1.101	0.205	0.968	0.290
Industries with risk index above one (yes=1, no=0)	0.452	0.498	0.373	0.484
Age of CEO	41.58	9.546	41.91	9.815
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.946	0.225	0.947	0.224
Foreign CEO	0.029	0.167	0.028	0.166
CEO has technical or vocational degree	0.173	0.378	0.182	0.386
CEO has college or university degree	0.605	0.489	0.620	0.485
Urban dummy (urban=1, rural=0)	0.774	0.418	0.779	0.415
Firm is a state-owned enterprise	0.017	0.129	0.014	0.118
Firm is a limited company	0.574	0.495	0.607	0.488
Firm is a joint-stock company	0.215	0.411	0.212	0.409
Firm is an FDI company	0.032	0.175	0.030	0.169
Log of labor size	2.248	1.297	2.108	1.323
Proportion of female workers	0.328	0.238	0.310	0.200
Proportion of social insurance workers	0.216	0.353	0.330	0.309
Log of total assets	8.102	1.931	8.706	1.604
Proportion of owned equity in total capital	0.623	0.339	0.473	0.248
Proportion of fixed assets in total capital	0.149	0.236	0.211	0.240

logit estimator is available, it is inefficient since it drops observations with time-invariant values of the dependent variable. Thus, we estimate the high-risk model (firms in industries with a risk index above one) using fixed-effect linear probability regression. Linear probability models are widely used when no non-linear probability estimators are available (e.g., Angrist, 2001; Angrist and Krueger, 2001). They are also more robust to the assumption of error term distribution (Nichols, 2011).

The last two columns of Table 3 show that the percentage of firms with female CEOs in high-risk industries is lower than firms with male CEOs. According to the extended model, the probability of female-managed firms operating in high-risk industries is 0.066 or 6.6 percentage points lower than male-managed firms. The coefficient of female CEOs in the extended model is smaller than that of the coefficient of female CEOs in the parsimonious model. This suggests that part of the difference in risk averseness between female and male CEOs can be explained by the difference in the explanatory variables used in the models. Thus female-managed firms tend to operate in industries with lower risk than male-managed firms even after a large number of observed variables and time-invariant unobserved variables are controlled for. The result suggests that female CEOs are more risk averse than male CEOs.

Table 3 also shows some interesting findings concerning the variables correlated with firm risk variables. There is an inverted U-shaped relation between the age of CEOs and risk. This means that the risk level of firms first increases as CEO age rises, but after achieving its peak, it decreases with age. For example, in the extended model of the risk index regression, the coefficient of CEO age is 0.0023, and the squared age of CEOs is -0.00003. This means that the risk index increases with the age of CEOs, and after achieving its peak at the age of 38.3, the risk index decreases with age. SOEs, FDI and joint-stock companies are more likely to operate in higher risk industries than private ones. Large firms tend to operate in high-risk industries. Firms with a larger share of owned equity and a smaller share of fixed assets in total capital are also more likely to operate in high-risk industries.

As mentioned, we also estimate the effect of CEO gender using the instrumental regression or 2SLS. The coefficient of the first-born girl on the number of siblings at the district level is used as the instrument for CEO gender of firms in districts. A higher value of the instrument means a greater preference for boys, and this means more gender discrimination against females. Since the instrument is measured at the district level, all firms within the same district will have the same value of the instrument. The first stage shows a strong negative effect of the instrument on female CEOs (Table 4). Location in districts with more gender inequality reduces the probability of a firm having a female CEO. In addition, we perform Cragg-Donald and Kleibergen-Paap weak identification tests on the instruments. The test statistics are very high,[1] indicating that the instrument is very strong. It can help to reduce potential bias if the instrument is correlated with error terms (i.e., the exclusion assumption does not hold). The second stage regression shows a strong, negative effect of female CEOs on the risk index in all four models, confirming the fixed-effect results. Female CEOs are more likely than male CEOs to select business industries with lower levels of risk.

One important factor that affects both the gender of CEOs and the selection of business industries is the firm ownership. SOEs and FDI firms has a lower rate female CEOs. SOEs have the lowest rate of operating in a high-risk industry, while

[1] As a rule of thumb, if an F- statistic is under 10, the instruments may be weak (Staiger and Stock, 1997).

Table A.3
OLS regressions of risk index and operating in high risk industries.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Risk index of industry		Firms in industries with risk index above one (yes=1, no=0)	
	Parsimonious model	Extended model	Parsimonious model	Extended model
Female CEO (female=1, male=0)	−0.0377***	−0.0213***	−0.1122***	−0.0586***
	(0.0008)	(0.0008)	(0.0016)	(0.0016)
Age of CEO	0.0046***	0.0038***	0.0100***	0.0086***
	(0.0003)	(0.0003)	(0.0005)	(0.0005)
Squared age of CEO	−0.0000***	−0.0000***	−0.0001***	−0.0001***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0225***	0.0095***	0.0564***	0.0262***
	(0.0024)	(0.0024)	(0.0042)	(0.0041)
Foreign CEO	0.0630***	0.0187***	0.1111***	0.0293***
	(0.0035)	(0.0049)	(0.0059)	(0.0089)
CEO has technical or vocational degree	0.0030**	0.0000	0.0533***	0.0451***
	(0.0012)	(0.0012)	(0.0022)	(0.0021)
CEO has college or university degree	0.0096***	−0.0031***	0.0701***	0.0403***
	(0.0010)	(0.0010)	(0.0018)	(0.0018)
Urban dummy (urban=1, rural=0)	−0.0023**	−0.0045***	0.0093***	0.0170***
	(0.0010)	(0.0010)	(0.0017)	(0.0017)
Firm is a private enterprise	*Reference*			
Firm is a state-owned enterprise		0.0102***		−0.0005
		(0.0035)		(0.0062)
Firm is a limited company		0.0379***		0.0700***
		(0.0013)		(0.0022)
Firm is a joint-stock company		0.0588***		0.1631***
		(0.0014)		(0.0026)
Firm is an FDI company		0.0834***		0.1622***
		(0.0045)		(0.0081)
Log of labor size		0.0220***		0.0652***
		(0.0004)		(0.0007)
Proportion of female workers		−0.0931***		−0.2840***
		(0.0017)		(0.0033)
Proportion of social insurance workers		−0.0498***		−0.0872***
		(0.0012)		(0.0023)
Log of total assets		0.0018***		−0.0028***
		(0.0003)		(0.0005)
Proportion of owned equity in total capital		0.0231***		0.1506***
		(0.0013)		(0.0025)
Proportion of fixed assets in total capital		−0.0749***		−0.1392***
		(0.0018)		(0.0032)
Dummy year 2013	−0.1330***	−0.1197***	−0.0802***	−0.0348***
	(0.0007)	(0.0008)	(0.0013)	(0.0014)
Constant	0.9792***	0.9496***	0.1205***	0.0194
	(0.0061)	(0.0065)	(0.0116)	(0.0121)
Observations	524862	524862	524862	524862
R-squared	0.07	0.10	0.02	0.08

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

FDI firms and joint-stock ones have the highest rate of operating in a high-risk industry. To further explore this issue, we split the sample of firms by ownership types: SOEs, private firms, and firms with foreign investment, and estimate

Table A.4
Firm fixed effects regressions of risk index and operating in high risk industries by the firm ownership types.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Dependent variable: Risk index of industry			Dependent variable: Risk index above one (yes=1, no=0)		
	Sample of state-owned enterprise	Sample of private firms	Sample of firms with foreign investment	Sample of state-owned enterprise	Sample of private firms	Sample of firms with foreign investment
Female CEO (female=1, male=0)	−0.0194 (0.015)	−0.0252*** (0.001)	−0.0257*** (0.002)	−0.0247 (0.023)	−0.0635*** (0.002)	−0.0817*** (0.005)
Age of CEO	−0.0083* (0.005)	0.0026*** (0.000)	0.0009 (0.001)	−0.0166** (0.008)	0.0076*** (0.001)	0.0028** (0.001)
Squared age of CEO	0.0001 (0.000)	−0.0000*** (0.000)	−0.0000 (0.000)	0.0001* (0.000)	−0.0001*** (0.000)	−0.0000 (0.000)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0388 (0.025)	0.0158*** (0.003)	−0.0147* (0.009)	0.0275 (0.053)	0.0339*** (0.005)	−0.0137 (0.016)
Foreign CEO	0.0943 (0.074)	0.0004 (0.009)	−0.0014 (0.010)	0.1529 (0.123)	0.0018 (0.016)	−0.0309* (0.017)
CEO has technical or vocational degree	0.0777*** (0.026)	−0.0014 (0.002)	0.0130*** (0.004)	0.0744* (0.038)	0.0396*** (0.003)	0.0386*** (0.007)
CEO has college or university degree	0.0449** (0.020)	−0.0017 (0.001)	0.0222*** (0.003)	0.0466 (0.035)	0.0267*** (0.002)	0.0627*** (0.006)
Urban dummy (urban=1, rural=0)	0.0515*** (0.011)	0.0094*** (0.002)	−0.0099*** (0.003)	0.1038*** (0.020)	0.0295*** (0.003)	0.0199*** (0.005)
Log of labor size	−0.0032 (0.003)	0.0210*** (0.001)	0.0118*** (0.001)	0.0024 (0.006)	0.0526*** (0.001)	0.0365*** (0.001)
Proportion of female workers	−0.2512*** (0.019)	−0.0390*** (0.002)	−0.1008*** (0.004)	−0.4423*** (0.036)	−0.1531*** (0.004)	−0.1924*** (0.007)
Proportion of social insurance workers	−0.0459*** (0.012)	−0.0371*** (0.002)	−0.0186*** (0.002)	−0.1048*** (0.020)	−0.0226*** (0.003)	−0.0161*** (0.005)
Log of total assets	−0.0048* (0.003)	0.0032*** (0.000)	0.0025*** (0.001)	−0.0098* (0.005)	0.0065*** (0.001)	−0.0014 (0.001)
Proportion of owned equity in total capital	−0.1621*** (0.012)	0.0131*** (0.002)	0.0476*** (0.003)	−0.1971*** (0.020)	0.0942*** (0.003)	0.1366*** (0.005)
Proportion of fixed assets in total capital	−0.1052*** (0.012)	−0.0660*** (0.002)	0.0242*** (0.004)	−0.1712*** (0.018)	−0.1010*** (0.004)	−0.0537*** (0.007)
Dummy year 2013	−0.1127*** (0.005)	−0.1106*** (0.001)	−0.1372*** (0.001)	0.0254*** (0.007)	−0.0610*** (0.001)	−0.0349*** (0.002)
Constant	1.5122*** (0.114)	0.9664*** (0.010)	1.0683*** (0.018)	1.2340*** (0.199)	0.0332* (0.018)	0.3304*** (0.034)
Observations	7,603	277,357	96,224	7,603	277,357	96,224
R-squared	0.175	0.143	0.234	0.012	0.027	0.029

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

the effect of CEO gender on the risk variables for each firm type. We estimate both firm fixed-effects and 2SLS regression using the extended model. Table 5 presents the coefficient of the female CEOs in the regressions. The full regression results are reported in Tables A.4 and A.5 in Appendix. The results from both the fixed-effects and 2SLS regressions show a negative effect of female CEOs on the risk level for private and foreign firms. Compared with male-managed firms, female-managed ones tend to operate in low-risk industries. However, the effect of female CEOs on the risk level of SOEs is not statistically significant. Possibly, this is because SOEs tend to do business in low-risk industries (results from second-stage regressions in Table 4), and there is a small variation in the risk level among SEOs as well as between female-managed and male-managed SOEs.

5.2. Decomposition analysis

Table 6 presents the decomposition of risk variables in firms with female CEOs and firms with male CEOs, using the extended model. The decomposition results using the parsimonious model are presented in Table A.3 in Appendix. The absolute gap in the dependent variables (the risk index and the dummy variable of high-risk industries) is decomposed into three components: endowments, coefficient, and interaction of explanatory variables. The sum of the three components across the explanatory variables is presented in the lower panels of the tables.

Table A.5
2SLS regressions of risk index and operating in high risk industries by the firm ownership types.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Dependent variable: Risk index of industry			Dependent variable: Risk index above one (yes=1, no=0)		
	Sample of state-owned enterprise	Sample of private firms	Sample of firms with foreign investment	Sample of state-owned enterprise	Sample of private firms	Sample of firms with foreign investment
Female CEO (female=1, male=0)	0.1244 (0.075)	−0.1117*** (0.015)	−0.6313*** (0.080)	0.0123 (0.052)	−0.4294*** (0.034)	−1.1850*** (0.164)
Age of CEO	0.0015*** (0.000)	0.0029*** (0.000)	0.0047*** (0.001)	−0.0050*** (0.002)	0.0081*** (0.001)	0.0079*** (0.002)
Squared age of CEO	−0.0000*** (0.000)	−0.0000*** (0.000)	−0.0001*** (0.000)	0.0000 (0.000)	−0.0001*** (0.000)	−0.0001*** (0.000)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0080** (0.004)	0.0136*** (0.003)	−0.0557*** (0.016)	0.0047 (0.011)	0.0541*** (0.007)	−0.1152*** (0.032)
Foreign CEO	−0.0437*** (0.011)	−0.0103 (0.009)	−0.1874*** (0.023)	−0.1305* (0.078)	−0.0049 (0.023)	−0.3364*** (0.047)
CEO has technical or vocational degree	0.0116*** (0.002)	0.0010 (0.002)	0.0048 (0.006)	0.0576*** (0.007)	0.0336*** (0.004)	0.0320** (0.013)
CEO has college or university degree	−0.0043** (0.002)	0.0043*** (0.001)	0.0068 (0.005)	0.0249*** (0.008)	0.0057 (0.004)	0.0352*** (0.011)
Urban dummy (urban=1, rural=0)	0.0142*** (0.002)	0.0433*** (0.002)	0.0360*** (0.004)	0.1383*** (0.006)	0.0993*** (0.004)	0.0953*** (0.009)
Log of labor size	0.0167*** (0.001)	0.0185*** (0.001)	0.0011 (0.002)	0.0072** (0.003)	0.0690*** (0.001)	0.0357*** (0.004)
Proportion of female workers	0.0982*** (0.013)	−0.0032 (0.009)	0.1710*** (0.039)	−0.1150*** (0.029)	0.0227 (0.022)	0.2186*** (0.080)
Proportion of social insurance workers	−0.0603*** (0.002)	−0.0614*** (0.002)	−0.0647*** (0.004)	−0.0706*** (0.009)	−0.1130*** (0.004)	−0.1251*** (0.009)
Log of total assets	0.0012** (0.000)	0.0094*** (0.000)	0.0063*** (0.001)	0.0151*** (0.002)	0.0030*** (0.001)	−0.0031* (0.002)
Proportion of owned equity in total capital	0.0247*** (0.002)	0.0154*** (0.002)	0.0067 (0.005)	−0.0575*** (0.008)	0.0950*** (0.004)	0.1057*** (0.010)
Proportion of fixed assets in total capital	−0.0090*** (0.003)	−0.0981*** (0.002)	−0.0398*** (0.006)	−0.1603*** (0.008)	0.0050 (0.006)	0.0366*** (0.013)
Constant	1.0597*** (0.013)	0.9189*** (0.009)	1.0833*** (0.032)	0.4666*** (0.047)	0.0191 (0.024)	0.4298*** (0.066)
Observations	4,172	181,576	60,840	4,172	181,576	60,840
Weak identification test Cragg-Donald Wald F statistic Kleibergen-Paap rk Wald F statistic	 8.525 9.943	 1393.4 1606.7	 112.4 127.1	 8.525 9.943	 1393.4 1606.7	 112.4 127.1

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6 presents the decomposition analysis of the risk index variable. Results of the decomposition of the dummy indicating high-risk industries are similar and presented in Table A.7 in Appendix. In this section we use the result from the decomposition of the risk index for interpretation. The risk index of firms with female CEOs is 0.041 lower than that of firms with male CEOs. The difference due to endowments is 0.023, accounting for 56% of the gap in the risk index between firms with and those without female CEOs. The difference due to coefficients is 0.024, accounting for around 58% of the gap. The remaining component, interaction, accounts for 14% of the gap. This means that differences due to endowment coefficients account for 114% of the gap in the risk index, while the interaction terms reduce the gap by 14%. The findings for the dummy variable of high-risk industries are very similar (Table A.7 in Appendix). Differences due to endowment coefficients account for 115% of the gap in the risk variable, while the interaction terms reduce the gap by 18%.

Table 6 presents the contribution of the differences between male- and female-managed firms in endowments and coefficients of explanatory variables. For simplicity in interpretation, we group explanatory variables in several groups including age, ethnicity and education of CEOs, firm ownership, labor size and structure, and asset. We compute the contribution of the differences in endowments and coefficients of these groups to the total difference in the risk level

Table A.6
Oaxaca–Blinder decomposition of risk index value and operating in a high risk industry using parsimonious model specification.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Risk index of industry			Firms in industries with risk index above one (yes=1, no=0)		
	Endowments	Coefficients	Interaction	Endowments	Coefficients	Interaction
Age of CEO	−0.0099***	−0.0790***	0.0038***	−0.0215***	−0.1360***	0.0065***
	(0.001)	(0.025)	(0.001)	(0.001)	(0.049)	(0.002)
Squared age of CEO	0.0089***	0.0426***	−0.0039***	0.0176***	0.0652***	−0.0059***
	(0.001)	(0.013)	(0.001)	(0.001)	(0.025)	(0.002)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0006***	−0.0267***	−0.0005***	0.0013***	−0.0561***	−0.0011***
	(0.000)	(0.004)	(0.000)	(0.000)	(0.009)	(0.000)
Foreign CEO	−0.0019***	−0.0003	0.0002	−0.0033***	0.0019***	−0.0015***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
CEO has technical or vocational degree	−0.0000	0.0018***	−0.0001***	−0.0003***	−0.0024***	0.0001**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)
CEO has college or university degree	−0.0003***	−0.0019	0.0001	−0.0022***	−0.0261***	0.0011***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)
Urban dummy (urban=1, rural=0)	0.0002***	−0.0236***	−0.0025***	0.0015***	−0.0468***	−0.0049***
	(0.000)	(0.002)	(0.000)	(0.000)	(0.003)	(0.000)
Dummy of the 2013 year	−0.0005**	−0.0077***	−0.0001**	−0.0003**	−0.0050***	−0.0000*
	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.000)
Differences						
Firms with female CEO	0.9988***			0.3174***		
	(0.001)			(0.001)		
Firms with male CEO	1.0398***			0.4371***		
	(0.000)			(0.001)		
Total absolute difference	−0.0410***			−0.1197***		
	(0.001)			(0.002)		
Difference due to endowments	−0.0030***			−0.0071***		
	(0.000)			(0.000)		
Difference due to coefficients	−0.0351***			−0.1068***		
	(0.001)			(0.002)		
Difference due to interaction	−0.0029***			−0.0058***		
	(0.000)			(0.001)		
Constant		0.0598***			0.0985***	
		(0.013)			(0.026)	

Robust standard errors in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

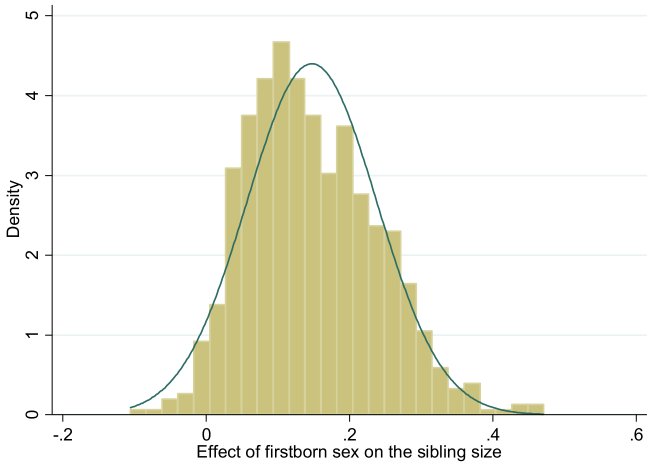

Fig. A.1. Effect of female firstborn on the number of siblings in districts.
Source: Authors' estimation from the 2009 Vietnam Population and Housing Census.

Table A.7
Oaxaca–Blinder decomposition of firms operating high-risk industry using the extended model.
Source: Authors' estimation using data from the 2011 and 2013 VECs and Deposit Insurance of Vietnam.

Explanatory variables	Dependent variable is 'Firms in industries with risk index above one (yes=1, no=0)'		
	Endowments	Coefficients	Interaction
Age of CEO	−0.0180***	−0.1066**	0.0051**
	(0.001)	(0.048)	(0.002)
Squared age of CEO	0.0139***	0.0266	−0.0024
	(0.001)	(0.024)	(0.002)
Ethnicity of CEO (Kinh=1, ethnic minority=0)	0.0007***	−0.0317***	−0.0006***
	(0.000)	(0.009)	(0.000)
Foreign CEO	−0.0011***	0.0014*	−0.0011*
	(0.000)	(0.001)	(0.001)
CEO has technical or vocational degree	−0.0003***	−0.0017**	0.0001*
	(0.000)	(0.001)	(0.000)
CEO has college or university degree	−0.0012***	−0.0082***	0.0004***
	(0.000)	(0.003)	(0.000)
Urban dummy (urban=1, rural=0)	0.0016***	−0.0245***	−0.0026***
	(0.000)	(0.003)	(0.000)
Firm is a private enterprise	Reference		
Firm is a state-owned enterprise	−0.0001	−0.0012***	0.0009***
	(0.000)	(0.000)	(0.000)
Firm is a limited company	0.0089***	−0.0453***	−0.0081***
	(0.000)	(0.003)	(0.001)
Firm is a joint-stock company	−0.0100***	−0.0202***	0.0049***
	(0.000)	(0.001)	(0.000)
Firm is an FDI company	−0.0047***	−0.0033***	0.0024***
	(0.000)	(0.001)	(0.000)
Log of labor size	−0.0181***	−0.0194***	0.0023***
	(0.000)	(0.004)	(0.000)
Proportion of female workers	−0.0439***	0.0676***	0.0283***
	(0.001)	(0.002)	(0.001)
Proportion of social insurance workers	−0.0004***	0.0158***	0.0003***
	(0.000)	(0.001)	(0.000)
Log of total assets	0.0002***	−0.0285***	0.0004***
	(0.000)	(0.010)	(0.000)
Proportion of owned equity in total capital	−0.0032***	0.0386***	−0.0017***
	(0.000)	(0.003)	(0.000)
Proportion of fixed assets in total capital	0.0060***	0.0408***	−0.0072***
	(0.000)	(0.001)	(0.000)
Dummy of the 2013 year	−0.0001**	−0.0162***	−0.0001**
	(0.000)	(0.002)	(0.000)
Overall difference			
Firms with female CEO	0.3174***		
	(0.001)		
Firms with male CEO	0.4371***		
	(0.001)		
Total absolute difference	−0.1197***		
	(0.002)		
Difference due to endowments	−0.0700***		
	(0.001)		
Difference due to coefficients	−0.0709***		
	(0.002)		
Difference due to interaction	0.0211***		
	(0.001)		
Constant		0.0451	
		(0.028)	

Robust standard errors in parentheses.,* significant at 10%; ** significant at 5%; *** significant at 1%.

between male- and female-managed firms. For example, the difference in the risk level between male- and female-managed firms is -0.041. The endowment differences in age and age squared are estimated at −0.0080 and 0.0066. The sum of these two parts is −0.0014, which is equal to 3.4% of the total difference (−0.041).

Fig. 4 presents these contributions. The difference in age between male and female CEOs has a small contribution to the difference in the risk index. However, the differences in the coefficients of age (or returns to age) contribute 88% to the total difference. It means that older CEOs tend to operate in riskier industries, and also male CEOs are generally older than female CEOs. Differences in ethnicity between male- and female CEOs contribute 42.7% to the total difference. Gender differences in education reduce the gap in risk level between male- and female-managed firms. Firm ownership is an important factor that explains the difference in the risk level between male- and female-managed firms. Differences in the

return to (or coefficients) labor and capitals tends to reduce the gap in the risk level between male- and female-managed firms.

6. Conclusion

In this study, we show that firms with female CEOs are more likely to operate in less risky industries than firms with male CEOs. The average risk index of firms with female CEOs is lower than that of firms with male CEOs. In the percentage of firms in high-risk industries, there was a large gap between firms with female CEOs and those with male CEOs. In 2013, 40.1% of firms with male CEOs operated in high-risk industries, while this figure was only 27.7% for firms with female CEOs. Using regressions which correct for selection bias, we also find a large effect of female CEOs on the risk index.

Using decomposition analysis, we examine factors explaining the risk difference between firms with female CEOs and those with male CEOs. The explanatory variables include demographic variables of CEOs and firms. It is found that the difference due to endowments is 0.023, accounting for 56% of the gap in the risk index between the firms with and those without female CEOs. The difference due to coefficients is 0.024, accounting for around 58% of the gap. The remaining component, interaction, accounts for 14% of the gap. This means that differences due to endowment coefficients account for 114% of the gap in the risk index, while the interaction terms reduce the gap by 14%. Among characteristics of CEOs and firms, differences in CEO age and firm ownership contribute the most to the difference in the risk index between male- and female-managed firms.

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Appendix

See Tables A.1–A.7 and Fig. A.1

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