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An Empirical Study for Corporate Risk Index: CEO Characteristics Affecting Corporate Risk-Taking

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Abstract: Using a sample population of CEOs from listed companies in China, we studied empirical important corporate risk index-risk-taking level by examining whether or not the CEO characteristics help explain their level of corporate risk taking. As corporate risk-taking level reflects CEOs' risk preference which was formed from their characteristics. We found that CEOs' age and education level are significant negatively related with corporate risk taking level. Female CEOs tend to maintain less leverage than male CEOs. Risk-taking level is greater at firms where CEOs are younger. CEOs with a higher level of education tend to maintain low volatility of earnings and have significant less leverage. These results help understanding corporate risk control and management in China.

Key words: CEO characteristics, risk preference, corporate risk-taking

INTRODUCTION

Corporate risk-taking is associated with managers' financial decisions and affects corporate survivability and development opportunity. It is generally measured by volatility of corporate earnings-as riskier operations lead to volatile returns to assets (John *et al.*, 2008) or by corporate survival, because corporations with less risky operations have greater likelihood of surviving. Faccio *et al.* (2012) also used leverage as a measure of riskiness. However, these measures may be too simplistic for a long-lived corporation, since factors such as good investments or a dominant industry play a role.

Guo (2013) suggested that Chinese CEOs should focus on corporate long-term development. As an important long-term growth index, corporate risk-taking may be affected by the relationship between CEO's characteristics and risk preferences, i.e., decision making regarding risky strategy and financial investments. Hambrick and Mason (1984) developed the "upper echelons" model to understand how top managers influence organizational decision making. They focused on observable characteristics and used those as key proxies for managers' cognitive orientations. Those observable characteristics include age, education, tenure, career experiences and financial position, as described separately below. Researchers have documented how managerial traits affect corporate performance (Brenner, 1988; Bertrand and Schoar, 2003;

Malmendier and Tate, 2005, 2008). In this study, the focus was corporate risk taking because it is an important index for corporate long-term growth and survival. The specific focus was the relations between corporate CEOs' gender, age, education and corporate risk taking among listed companies in China.

Marianne (2011) concluded that women are more risk averse than men in wide-ranging circumstances. Powell and Ansic (1997) applied a computerized experiment with undergraduate and post-graduate business students using real financial data to examine gender differences in realistic financial decisions. There were distinctive strategies in financial decision-making; men tended to undervalue and women to overvalue, the current situation's risk. Men also had a higher preference for risk than women. Byrnes *et al.* (1999) analyzed 150 studies of gender differences in risk-taking tendencies. Studies were coded according to type of task, task content and age. Results indicate a clear support of that man is more likely to take risks than women participants. Faccio *et al.* (2012) studied female CEOs in both private and public companies in 18 countries from 1999-2009. Using leverage and riskiness outcomes as measures of risk-taking, they found that female CEOs were more risk-averse in financial strategies.

Prospect theory proposes a difference of individuals' attitudes toward risk concerning gains and losses. People willing to earn a lower income to avoid losses are risk averse (Kahneman and Tversky, 1979). In expected utility theory, a risk-averse individual prefers certain returns

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despite a lower profit. As women are more risk averse, female CEOs would be predicted to have a lower risk preference and select the strategy with less possibility of loss, e.g., less debt and investments:

Hypothesis 1: Female CEOs' corporate volatility of earnings will be lower
Hypothesis 2: Female CEOs' corporate leverage will be less

Ryan and Wiggins (2001) examined 1,095 firms from the S and P 500, the Midcap 400 and the Smallcap 600. They found a concave relationship between cash bonuses and CEOs' age and a negative linear relation between stock options and age, suggesting that there is a significant relationship between decision making and a manager's age. Barker and Mueller (2002) adopted a sample of publicly-held companies to investigate how CEOs' characteristics related to investment decision making by using research and development (R and D) spending as measurement. They found younger CEOs were more willing to invest in R and D. They also found that CEOs' formal education had no significant relation with R and D spending. Bertrand and Schoar (2003) constructed a manager-firm panel dataset describing 600 firms and 500 managers to investigate the influences of managers' corporate decisions. They found older CEOs tended to be more financially conservative, as older generations of CEOs maintained lower financial leverage, interest coverage and cash holdings.

Liu *et al.* (2011) studied publicly-held listed companies in China. They randomly chose 650 corporations and found that the mean age of Chinese top management teams was positively related to the firms' performance which was measured by Return on Asset (ROA) and Return on Sales (ROS), especially in larger companies. Wei *et al.* (2005) reported a similar finding of a positive relation between the average age of Chinese top management teams and corporate return on asset.

As younger CEOs and managers are more willing in investing and pursuing profits in prior literatures' discussions, younger CEOs would have higher risk preferences for the purpose of gaining more earnings, which will directly lead to a higher corporate volatile earnings and debts:

Hypothesis 3: CEO age will be negatively associated with volatility of earnings
Hypothesis 4: CEO age will be negatively associated with leverage

Researchers have shown managers' decision-making styles and risk preferences differed by their education level. Tyler and Steensma (1998) assessed top executives from public and private companies with two education levels; they graduated from a large midwestern university or a smaller engineering school with excellent reputation; executives with technical degrees tended to pursue more technological alliances. Bertrand and Schoar (2003) found managers with educational backgrounds in management tended to be more aggressive in risk preference, so their firms had higher capital expenses and liabilities. Karagiannidis (2012) used a dataset consist of 1,678 mutual fund managers, finding that managers with graduate business backgrounds had better performance and held less risky portfolios.

In human capital theory, pursuing education is an investment. The higher the degree obtained, the larger the investment, which implies a higher expected return. Choice theory assumes all investors are rational, seeking to gain as much as possible with the least possible risk. CEOs with higher level of education would be more rational as they invested more in education and expected more as return. Those who invested in education will be more cautious about risky financial strategies to ensure real profits. If the balance of expected return and risks is not satisfactory, they would tend to hold steady. Thus, corporations run by them maintain less risky financial operations and therefore less volatility in returns and liabilities:

Hypothesis 5: CEO's education level will be negatively associated with volatility of earnings
Hypothesis 6: CEO's education level will be negatively associated with leverage

MATERIALS AND METHODS

Data collection: The accounting data for Chinese-listed companies from 2004-2013 and most of the CEOs' information (age, gender and education) were collected from the CSMAR database, a comprehensive financial database covering 75 sub-databases of Chinese economics and finance developed specifically for the Chinese market by the GTA Finance and Education Group. The rest of the CEOs' information (mainly educational information) was obtained from corporate annual reports, corporate websites and search engines such as Google. Extreme values were adjusted by eliminating corporations with imperfect information, those belonging to the financial industry and those without

continuous data over 4-year periods. Consequently, corporate financial and CEO information were obtained for a dataset that included 1,928 observations.

Measures of risk taking:

Risk-taking: We used two measures of risk-taking. The first measure is volatility of corporate earnings, which is the volatility of the corporate return on assets. Volatility of earnings is used as a standard proxy of risk and captures the riskiness of investment decisions (Faccio *et al.*, 2012). John *et al.* (2008) found that volatility of corporate' earnings is positively associated with long term economic growth. According to the approach of John *et al.* (2008) and Paligorova (2010), we calculated the ratio of earnings before interest and taxes to total assets. Then the standard deviation of this ratio over 4-year overlapping windows is used as proxy for risk (2004-2007, 2005-2008, 2006-2009, 2007-2010, 2008-2011, 2009-2012, 2010-2013). The second measure we used is leverage, which is the ratio of financial debt (short term and long term) divided by total assets (sum of financial debt plus equity). Leverage is a convincing measure because higher leverage corresponds to both a higher probability of a firm's failure and a greater effect on its profitability. This variable captures risk preference of corporate decision maker. As CEO is one of the most important decision makers for corporate, thus these two variables are highly related to their risk preference.

Education: Level of education was classified into five categories: 1 for weak background (zero schooling, secondary school, or lower), 2 for college, 3 for undergraduate degree, 4 for postgraduate degree and 5 for doctoral degree.

Gender: Dummy coded 0 for male CEO or 1 for female CEO.

Control variables: Several variables controlled for variation of corporate risk-taking. Growth was the annual sales growth rate. Return on Assets (ROA) was the ratio of earnings before interest and taxes to total assets (Khanna and Yafeh, 2005; John *et al.*, 2008; Laeven and Levine, 2009). Ownership was the cash flow right of the largest shareholder. This variable controls for agency conflicts. High ownership percentage is related to greater incentive and ability to control or monitor the CEO (Claessens *et al.*, 2000; Faccio and Lang, 2002). Size of company was defined as the natural log of total assets.

Industry dummy variable: Since the sample corporations were from different industries, dummy variables were included to control for the industries effects. Industry dummies (manufacture or agriculture) indicated corporation industry; "mining industry" was the omitted category.

Regression model:

$$\text{Risk vol} = \beta_0 + \beta_1 \text{ Edu} + \beta_2 \text{ Age} + \beta_3 \text{ Gender} + \beta_4 \text{ Growth} + \beta_5 \text{ ROA} + \beta_6 \text{ Ownership} + \beta_7 \text{ Size} + \beta_8 \text{ lev} + \beta_i d_i + \varepsilon$$

$$\text{Risk lev} = \gamma_0 + \gamma_1 \text{ Edu} + \gamma_2 \text{ Age} + \gamma_3 \text{ Gender} + \gamma_4 \text{ Growth} + \gamma_5 \text{ ROA} + \gamma_6 \text{ Ownership} + \gamma_7 \text{ Size} + \gamma_i d_i + \varepsilon$$

Risk-taking measure of volatility of earnings is predicted by education, age and gender of CEO plus growth, Return on Assets (ROA), ownership, corporate size and leverage.

Risk-taking measure of leverage is predicted by education, age and gender of CEO, plus growth, Return on Assets (ROA), ownership and corporate size.

RESULTS

Descriptive statistics: The descriptive statistics and correlations matrix of this study are shown in Table 1 and 2. Of the CEOs, 6.4% (n = 123) were female, 93.6% (n = 1805) were male. The mean age of CEOs of listed companies in China is 45.9 year (Mdn = 45 year). Mean education level was 3.45, median value is 3, so most CEOs had bachelor's (coded 3) or Master's degrees

Table 1: Descriptive statistics

Variables	M	SD	Min.	Max.	Mdn.
Volatility	0.05	0.05	0.01	0.28	0.03
Leverage	0.50	0.30	0.05	1.84	0.49
Gender	0.06	0.25	0.00	1.00	0.00
Age	45.93	6.37	28.00	67.00	45.00
Education	3.45	0.79	1.00	5.00	3.00
Growth	0.05	0.08	-0.31	0.26	0.06
Return on assets	0.41	1.69	-0.89	13.67	0.08
Ownership	37.32	16.43	9.09	75.00	35.05
Size	21.56	1.29	18.85	25.22	21.47

Table 2: Correlation matrix

Variables	1	2	3	4	5	6	7	8
Volatility	1.00							
Leverage	0.39**							
Gender	-0.01	-0.06						
Age	-0.01	-0.05	-0.11**					
Education	0.06	-0.04	-0.08**	-0.16				
Growth	0.06	0.02	0.17**	-0.03	-0.05**			
Return on assets	-0.19**	-0.20**	0.02	-0.03	-0.02	-0.03		
Ownership	-0.15**	-0.16**	0.05	-0.01	0.11*	0.04	0.09*	
Size	-0.34**	0.02	-0.06	0.18**	0.15**	-0.04	0.16**	0.20**

**p<5 and 1%, respectively

(coded 4). Mean volatility of earnings was 4.65% (Mdn = 2.92%), so most corporations maintained low asset volatility. However, the minimum value of 1% while the maximum 28% suggest large differences in volatility between corporations. Mean leverage was 49.67% (Mdn = 48.83%). This means that most listed companies in China maintain liabilities at no more than the half of total assets. Table 2 shows that volatility of earnings was negatively correlated with CEOs' age and positively with education level, while leverage had significantly negative correlations with gender, age and education level. All correlation coefficients were non-significant or weak.

Volatility is the volatility of the corporate return on assets, defined as the standard deviation of the ratio of earnings before interest and taxes to total assets. Leverage is defined as the ratio of financial debt (short term and long term) divided by total assets (sum of financial debt plus equity). Gender is an indicator variable that takes the value of 1 if the CEO is female and 0 otherwise. Age is CEOs' age in observed year. Education is an indicator variable of education level that takes the value of 1 for weak background, 2 for college, 3 for undergraduate, 4 for postgraduate and 5 for doctoral degree. Growth is calculated as the annual sales growth rate. Return on assets is the ratio of earnings before interest and taxes to total assets. Ownership is the cash flow right of the largest shareholder. Size is defined as the natural log of total assets.

Gender and risk-taking: t-test was used to compare the means of risk-taking variables (earning volatility and leverage) between male and female CEOs. Corporations run by male CEOs have higher risk taking level than those of corporations run by female CEOs. For the dependent variable of earning volatility, mean of male CEOs is 5% with SD = 0.05, mean of female CEOs is 4% with SD = 0.04, not significant. For the dependent variable of leverage, mean of male CEOs is 50% with SD = 0.30, mean of female CEOs is 42% with SD = 0.25, significant. These results indicated that male CEOs tended to maintain higher risk-taking than female CEOs as measured by leverage. However, the gender difference in volatility of earnings was not statistically significant.

Regressions predicting risk-taking: Ordinary Least Squares (OLS) regression was applied to test hypotheses (Table 3 and 4). Table 3 shows the results using volatility of earnings as the risk-taking measure. CEOs' age was negatively related to the volatility of earnings, so older CEOs maintained lower volatility of corporate returns, supporting hypothesis 3. Education level was negatively

Table 3: CEO characteristics and volatility of earning

Variable	B	t
Intercept	0.43**	8.41
Return on assets	-0.04	-1.72
Growth	0.01	1.36
Leverage	0.06**	10.35
Gender	0.01	0.27
Age	-0.01*	-2.32
Education	-0.01**	4.13
Size	-0.02**	-10.48
Ownership	-0.06**	-4.12
R^2	0.33	
Adj R^2	0.31	
F	23.46	

*,**$p<5$ and 1%, respectively

Table 4: CEO characteristics and leverage

Variable	B	t
Intercept	0.55	2.45
Return on assets	-0.83**	-5.43
Growth	0.01	0.57
Gender	-0.08	-1.59
Age	-0.01*	-2.28
Education	-0.02	-1.47
Size	0.03**	2.96
Ownership	-0.11**	-4.04
R^2	0.10	
Adj R^2	0.09	
F	6.60	

*,**$p<5$ and 1%, respectively

related to volatility of earnings, so CEOs with more education tended to maintain lower volatility of corporate earnings, supporting hypothesis 5. Gender was not statistically significant, thus hypothesis 1 was not supported.

Table 4 shows the results using leverage as the risk-taking measure. CEOs' gender, age and education level were negatively related to corporate leverage. Female, older and more educated CEOs tended to maintain less debt, supporting hypotheses 2, 4 and 6.

Reports regression results: The dependent variable is volatility of earning, defined as defined as the standard deviation of the ratio of earnings before interest and taxes to total assets. Return on assets is the ratio of earnings before interest and taxes to total assets. Growth is calculated as the annual sales growth rate. Leverage is defined as the ratio of financial debt (short term and long term) divided by total assets (sum of financial debt plus equity). Gender is an indicator variable that takes the value of 1 if the CEO is female and 0 otherwise. Age is CEOs' age in observed year. Education is an indicator variable of education level that takes the value of 1 for weak background, 2 for college, 3 for undergraduate, 4 for postgraduate and 5 for doctoral degree. Size is defined as the natural log of total assets. Ownership is the cash flow right of the largest shareholder.

DISCUSSION

This result is consistent with prior literatures of gender differences in risk-taking, women are more risk averse than men. Age is significant negatively related to corporate risk-taking level. Risk-taking level is greater at firms where CEOs are younger. This could be explained as younger CEOs have greater incentive for investment and innovations, instead of maintain a stable, average, long term growth, younger CEOs prefer profitable financial strategy therefore bring about active financial activities (Barker and Mueller, 2002). Desire of career success of younger CEOs can be one of important factor either. CEOs with a higher level of education tend to take less financial risk, maintaining lower volatility of corporate earnings and less leverage.

There are several limitations. This study was conducted on Chinese listed companies and CEOs, sexism is wildly exist especially in business field, career women in China are required stronger mental quality and social ability, these demands make them a different population than just a "female". Research of gender differences in risk-taking could be more specific by focusing on the research of female managers population's personal traits and comparing with other countries. Croson and Gneezy (2009) proposed that among the population of corporate managers, financial risk preferences are smaller than in the general population. Further study could explore and verify this point of view. Gender differences in risk-taking did not pass the significant test in measure of volatility of earnings in this study, thus further examination and improvement can be done in here. We did not take into account other characteristics such as professional background and work experience. Future researchers could consider these factors and include companies beyond China when conducting studies on corporate growth, the determinants of risk taking and human capital investment.

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