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Human and relational capital behind the structural power of CEOs in Chinese listed firms

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Abstract This study examines the human and relational capital attributes that enable Chief Executive Officers (CEOs) to acquire structural power in Chinese listed firms, and whether gender differences intervene in the attributes that explain this structural power. We show that CEOs with elite education, longer years of education and work experience and more outside directorships are more likely to gain structural power in Chinese listed firms. However, female CEOs are less likely than male CEOs to achieve similar structural power, while only outside directorships, as a proxy for relational capital, compensate for this gender inequality. Employing human capital theory, our study advances the knowledge on CEO leadership by revealing the role of human and relational attributes to explain CEO structural power. Further, our study provides new insights about upward mobility and gender inequality in a fast emerging economy.

Keywords China · Chief executive officer (CEO) · Human capital · Relational capital · CEO gender · Structural power

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This study examines the human and relational capital attributes that enable Chief Executive Officers (CEOs) to acquire structural power, and whether gender intervenes in the attributes that explain this structural power in Chinese listed firms. As Finkelstein (1992) argued, power emanates from managers' personal abilities, plays a key role in decision making, and greatly influences board effectiveness. Previous studies, however, have focused on the effects of CEO power on firm-level outcomes (e.g., Finkelstein, 1992; Haynes & Hillman, 2010; Lewellyn & Muller-Kahle, 2012; Li & Tang, 2010; Muller-Kahle & Lewellyn, 2011), while little is known about how executives gain structural power in their organizations (Daily & Johnson, 1997; Muller-Kahle & Schiehll, 2013; Singh, Terjesen, & Vinnicombe, 2008; Smith, 2012). We, therefore, extend and deepen this line of inquiry by considering human and relational capital as a critical source of CEO structural power. Since individuals with stronger human and relational capital are assumed to be able to make better decisions (Becker, 1964, 1971; Dalziel, Gentry, & Bowerman, 2011; Hillman & Dalziel, 2003; Schiehll, Lewellyn, & Muller-Kahle, 2017), we expect that individual capabilities foster CEOs' upward mobility (Bigley & Wiersema, 2002; Finkelstein, 1992; Peng, Sun, & Markóczy, 2015; Rosenbaum, 1984). Thus, more attention should be paid to human and relational capital theory in an attempt to explain CEO structural power, which constitutes the main motivation for our study.

Since the criteria for upward mobility can be vague and subjective, the process of obtaining structural power is somewhat susceptible to discrimination (Muller-Kahle & Schiehll, 2013; Powell, 1999; Smith, 2002). Some scholars argue that a male is more likely than a female to be selected to receive higher levels of trust, support and career-related information and opportunities, making the capability of a female less likely to be recognized in the organization (Cooke, 2003; Smith, 2002, 2012; Tan, 2008). Although many female managers have more years of formal education than male managers (Catalyst, 2016) and many of them have similar qualifications for executive positions (Dezsö & Ross, 2012), women continue to be scarce at the very top (e.g., CEO or Chairman). Therefore, whether gender intervenes in the human and relational capital attributes that explain CEOs' structural power constitutes our second motivation for this study.

Extending this line of inquiry to Chinese listed firms is interesting for several reasons. First, China's economic marketization reform has drastically increased the demand for human and relational capital in market competition, making employees with superior expertise more likely to be assigned to higher positions (Cao, 2001; Giannetti, Liao, & Yu, 2015; Nee, 1989; Peng et al., 2015). Second, due to concentrated ownership structures as well as political interventions, power is highly concentrated in Chinese listed firms (Jiang & Kim, 2015; Kato & Long, 2006). This concentration of power creates greater incentives for executives to exchange their human and relational capital for upward mobility, and thus strengthens the demand and supply relationship of human and relational capital in explaining structural power (Cao, 2001; Chen, Liu, & Li, 2010; Peng et al., 2015). Third, because of weak formal institutions and strong informal systems (Allen, Qian, & Qian, 2005; Xin & Pearce, 1996), relational capital is far more influential in the executive job market in China than in most Western countries. This provides an instructive opportunity to analyze the influence of relational capital on leadership. Fourth, the ideology underlying female discrimination is rooted in Eastern culture and tradition (Cao, 2001; Cooke, 2003; Terjesen, Aguilera, & Lorenz, 2015; Terjesen, Sealy, & Singh, 2009; Yukongdi & Rowley, 2009), making

China an interesting setting to explore whether human and relational capital can compensate for gender barriers on CEO careers.

Our results suggest that formal education, work experience and outside directorships greatly explain the presence of CEO structural power in China. Our findings corroborate the individual level perspective proposed by Powell (1999) and Hillman and Dalziel (2003), whereby human and relational capital are complementary assets that enable a better understanding of CEO upward mobility. Our findings also suggest that, even though the number of female CEOs is growing in Chinese listed firms, female CEOs continue to face more barriers than male CEOs to achieve structural power. More importantly, our results suggest that only multiple directorships—relational capital—are able to compensate for gender inequality in Chinese listed firms.

This study contributes to the literature on human and relational capital and CEO leadership in three main aspects. First, existing studies have long considered CEO power a threat to shareholder wealth (Haynes & Hillman, 2010; Lewellyn & Muller-Kahle, 2012; Li & Tang, 2010). However, after tracing back to the source of CEO structural power, we show that CEO structural power comes from the human and relational capital that the CEO brings to the firm, which is assumed to contribute to firm value creation. Second, our results extend our understanding of the benefits for upward mobility of investing in human and relational capital in transition economies (Nee, 1989), and emphasize the role of relational capital in the Chinese managerial market (Allen et al., 2005; Fan & Wong, 2004; Xin & Pearce, 1996; You & Du, 2012). Third, our findings shed new light on gender inequality (e.g., Lam, McGuinness, & Vieito, 2013; Liu, Wei, & Xie, 2014; McGuinness, Lam, & Vieito, 2015; Ye, Zhang, & Rezaee, 2010). We demonstrate that, despite the sharp rise in Chinese female CEOs, the glass ceiling remains, supporting claims that gender inequality increases as the workplace power rises (Elliott & Smith, 2004; Powell, 1999; Smith, 2002, 2012). Finally, our study also has practical implications, as it provides evidence that the standards for achieving power within the organization differ between female and male CEOs. This calls for organizations to provide equitable training and promotion opportunities for females and males alike, and echoes Jiang and Kim (2015), who argued that managerial talent markets and promotion standards for managers are different and independent in China.

The next section describes our institutional context, followed by our theoretical background and hypotheses development. Data collection and research methods are then explained, followed by the empirical results, robustness checks, and discussion. The final section summarizes the findings and contributions.

Institutional context and motivation

Our research context is China, the largest emerging economy and the second largest economy in the world (World Bank, 2017). In comparison to previous literature on managerial power, which mainly focus on developed countries and under the stable Anglo-Saxon context (see the review by van Essen, Otten, & Carberry, 2015), China's economic reform led to significant changes in "the determinants of socioeconomic attainment and therefore the sources of power and privilege" (Nee, 1989: 663).[1] The

[1] Few exceptions are the studies by Li and Tang (2010), You and Du (2012) and Lam et al. (2013).

1990s marketization economic reform exposed Chinese firms to increased market competition, thus gave rise to higher returns in human and relational capital investments (Cao, 2001; Nee & Opper, 2012; Peng et al., 2015). An important effect of these reforms is the growth of the top management labor market, and especially for skilled CEOs (Jiang & Kim, 2015; Peng et al., 2015). Before such reforms, top management mobility in China was low and mainly under restrictive control by the government (Jiang & Kim, 2015; Yukongdi & Benson, 2005; Yukongdi & Rowley, 2009). Such a transition has increased managerial labor market mobility and has promoted the human and relational capital demand and supply relationship as a key driver of the managerial labor market (Chen et al., 2010; Nee, 1989; Peng et al., 2015). Since Chinese firms face competitive pressure to optimize their managerial deployment in order to survive and to enhance efficiency, employees are more likely to be respected for the productivity and efficiency they bring to the organization (Nee & Opper, 2012; Peng et al., 2015). At the same time, Chinese firms learned to value human and relational capital as an important factor in allocating managerial personnel to retain and attract managerial talent (Cao, 2001; Jiang & Kim, 2015). Based on the above discussion, we contend that Chinese listed firms provide an interesting research setting for our investigation, which employs human capital theory (Becker, 1964, 1971) to examine the human and relational capital attributes that enable CEOs to acquire structural power in China and whether gender intervenes in the attributes that explain such structural power.

Theoretical background and research hypotheses

Like other types of capital which builds on initial investments and generates future income over a long period, human capital comprises an individual's investment in the "intangible" forms of capital such as knowledge, skills, health, or values, which add to future returns over an individual's lifetime (Becker, 1964, 1971). Moreover, as an important dimension of human capital,[2] relational capital is "the sum of the actual and potential resources embedded within, available through, and derived from, the network of relationships processed by an individual" (Nahapiet & Ghoshal, 1998: 243). Human capital theory has been widely used to understand executives' effectiveness, which predicts that through investments in human and relational capital (e.g., education, experience, social ties), CEOs acquire high cognitive ability and knowledge to contribute to firm value creation (Dalziel et al., 2011; Haynes & Hillman, 2010; Hillman & Dalziel, 2003; Peng et al., 2015; Schiehll et al., 2017). As Peng et al. (2015: 118) stated, "Because CEOs are aware that their human capital adds value, they are interested in leveraging it." Upward mobility can be considered an important reward for individuals' capability and effort, which contains not only direct compensation, but also legitimacy, reputation, cooperative partnership, personal fulfilment and future opportunities (Sicherman & Galor, 1990). Previous evidence supports this argument and shows that executives' upward mobility can be considered the prize based on how hard they work

[2] As Haynes and Hillman (2010: 1147) mentioned, recognizing "the independent nature of human and social capital…and the difficulty of isolating the effect of one from the other" we follow the argument built by Peng et al. (2015: 120) and consider that "A broader definition of human capital may also include social capital, defined as a resource that is embedded in a CEO's network relationships such as political ties." We therefore contend that relational capital could be considered a dimension of human capital.

and the human and relational capital they possess (e.g., Bhagat, Bolton, & Subramanian, 2010; Bigley & Wiersema, 2002; Rosenbaum, 1984; Sicherman & Galor, 1990; Zajac & Westphal, 1996). Following this line of reasoning, in the next section we discuss how human and relational capital attributes can explain the structural power of CEOs in Chinese listed firms.

Educational qualification

Years of formal education and the quality of this education are the most institutive investments that enhance human capital by conferring skills and technical knowledge that qualify individuals for more complex jobs (Becker, 1964; Dalziel et al., 2011). Sicherman and Galor (1990) found that the process of occupational upgrading in the organizational hierarchy represents a critical part of the expected achievement when individuals invest in education. After analyzing 2,600 CEO turnover cases in the US, Bhagat et al. (2010) found that CEOs with higher levels of education are more likely to be appointed. Similarly, Jalbert, Rao, and Jalbert (2002) showed that large US firms recognize educational backgrounds for CEO selection and Crumley (2008) found that education generates bargaining power for CEOs to increase their compensation. Since education is costly and time-consuming, individuals invest in formal education in order to foster their future productivity, which in turn, supports their organizations and contributes to their own career attainment (Rosenbaum, 1984).

The quality of education is also a critical dimension. Elite schools with their highly prestigious and selective admission structures choose only the top candidates for their programs (Dalziel et al., 2011; Liu & Jia, 2017). Those who graduate from elite schools receive prestige and legitimacy transferred from educational institutions and valuable social networks generated from elite alumni (Daily & Johnson, 1997). Elite education also signals superior cognitive and analytical abilities (Useem, 1979), making those with an elite education more likely to be given structural power. Along this line, Liu and Jia (2017) showed that attending an elite university in China has a crucial bearing on career prospects and greatly influences one's upward mobility. Moreover, statistics show that most CEOs, because of their age, are likely to have been influenced by the Cultural Revolution and the consequent college education shutdown in China[3] (e.g., Fan & Wong, 2004; Kato & Long, 2006; Liu et al., 2014). This would not only make formal education a rare resource for CEOs in the labor market competition, but also push firms to strengthen the relationship between education and upward mobility (Jiang & Kim, 2015). This evidence supports our argument that educational qualifications—length and quality—play an important role in building CEOs' human capital, and ultimately increase their likelihood of achieving structural power as a reward in Chinese listed firms. This leads to the following hypothesis:

Hypothesis 1 In Chinese listed firms, educational qualifications (years of education and elite education) are positively associated with the likelihood of the CEO to have structural power.

[3] During the Chinese Cultural Revolution, college entry examinations were halted from 1966 to 1977, preventing enormous numbers of people born in the 1950s from getting a university level education (Cao, 2001; Fan & Wong, 2004). As Liu and Jia (2017) suggested, China's College Entrance Exam not only determines whether a young person will attend a Chinese university, but also which one.

Work experience

Similar to educational qualifications, work experience fosters human capital by increasing applied knowledge and expertise in specific positions, and developing valuable firm-specific experiences (Becker, 1964; Dalziel et al., 2011; Wayne, Liden, Kraimer, & Graf, 1999). Many scholars argue that work experience facilitates upward mobility and is even more important than education for promotion to top management positions (Powell, 1999). As firms vary in history, culture, and external threats and opportunities, work experience allows CEOs to apply and acquire new skills building on past knowledge and, thus, manage uncertainties more successfully (Dalziel et al., 2011; Johnson, Schnatterly, & Hill, 2013; Wayne et al., 1999). Moreover, because of the political movement in China, people started to work at a very young age during the Cultural Revolution period (Liu & Jia, 2017), suggesting that work experience may be a critical source for CEOs in China to build human capital to remedy the missed access to education. We, therefore, propose that on-the-job experience is an important component of CEOs' human capital, making them hard to be replaced and at the same time strengthening their bargaining ability in terms of upward mobility in Chinese listed firms:

Hypothesis 2 In Chinese listed firms, work experience is positively associated with the likelihood of the CEO to have structural power.

As Finkelstein (1992) stated, CEOs could gain power through their outstanding ability for external contact and interorganizational communication. Taking the form of investments into building informal social networks, relational capital provides access to valuable information and critical job-related knowledge that is often difficult to obtain through formal channels (Finkelstein, 1992; Peng et al., 2015; Xin & Pearce, 1996). Moreover, in contrast to Western countries, which are largely based on formal institutions (e.g., contracts, rules, and laws), informal institutions (e.g., *guanxi*, or private relationships) operate in China and contribute to an unstable legal environment (Allen et al., 2005; Xin & Pearce, 1996). Thus, Chinese firms rely intensively on personal trust and private relationships for all aspects of daily operations including obtaining projects, investments, licenses, or government permits (Allen et al., 2005), making relational capital an important attribute to explain CEO structural power (Powell, 1999; Smith, 2002). As such, we examine two attributes related to a CEO's relational capital: political ties and multiple directorships.

Political ties

Uncertainties caused by government policies or regulations are major environmental threats with potential impacts on firm performance (Pfeffer & Salancik, 1978). As the government is the major market participant and the rule maker in China (Allen et al., 2005; Ma & DeDeo, 2018), CEOs with political ties are able to obtain resources from political elites and the government to support their firms, and may also influence the government's decisions in favor of their firms to reduce external risks (Ma & DeDeo, 2018; Peng et al., 2015; Shi, Markóczy, & Stan, 2014). Fan and Wong (2004) found that political connections increase the likelihood of CEOs to be appointed, while You and Du (2012) found that

political ties greatly increase CEOs' power by making them less likely to be dismissed even in cases of bad firm performance in Chinese listed firms. All these corroborate the idea that CEOs may use their political ties to support their organization, and at the same time consolidate their managerial positions and increase their upward mobility in China, which leads to the following hypothesis.

Hypothesis 3 In Chinese listed firms, political ties are positively associated with the likelihood for the CEO to have structural power.

Directorships

Multiple directorships (i.e., sitting on a board of directors of another firm) create channels for knowledge exchange with other firms (Fich & White, 2005). Pfeffer and Salancik (1978) argued that through interacting with leaders in other firms, CEOs could gain firsthand information and insights, learn new approaches, and modify their own businesses accordingly. This combination of broader experience and useful information channels are expected to contribute to firm performance and enhance the power of CEOs to influence boardroom discussions (Fich & White, 2005; Hillman & Dalziel, 2003). In China, firms have been found closely connected together by reciprocally sitting on each other's boards, and only executives involved in those interorganizational networks are able to achieve privileged positions (Ma & DeDeo, 2018). Thus, due to their ability to quickly update information and facilitate communication, CEOs who are seated on outside boards have more control over their firms' daily operations and, thus, are more likely to benefit themselves by consolidating their status and increasing their power within the firm (Bigley & Wiersema, 2002). This leads to the following hypothesis:

Hypothesis 4 In Chinese listed firms, outside directorships are positively associated with the likelihood for the CEO to have structural power.

CEO gender

The upward mobility mechanism in a corporate hierarchy is often considered a subjective selection process through which women may incur gender discrimination (e.g., Lyness & Thompson, 1997; Muller-Kahle & Schiehll, 2013; Smith, 2002, 2012). Moreover, many scholars argue that women in transition economies like China face greater difficulties compared to their peers in developed countries (Leung, 2003; Tan, 2008; Terjesen et al., 2009, 2015).[4] Powell (1999) suggested that what hinders women from obtaining structural power can be analyzed from three levels. At the societal level, Chinese women face not only a "glass ceiling" but also a "bamboo curtain" stemming from Confucian ideology entrenched in Eastern culture and tradition (Liu, Meng, & Zhang, 2000; Liu et al., 2014; Tan, 2008). Under this masculine value system, women have long been labeled as family caretakers and subordinates of men (Cooke, 2003; Leung, 2003; Liu et al., 2000).

[4] Although China's female labor participation rate began to grow around the time of the Cultural Revolution in the 1960s (Cooke, 2003; Tan, 2008), economic reforms and the retreat of communist ideology during the 1970s and 1980s led to setbacks in gender equality policies (Zhang & Dong, 2008).

At the organizational level, although state-owned enterprises (SOEs) comprise about half of Chinese listed firms (Allen et al., 2005), these firms did not contribute much to the recent rise of female CEOs in China (Lam et al., 2013; Liu et al., 2014), probably due to the SOE reform in 1990s which led to massive layoffs, of which female employees accounted for a large proportion (Cooke, 2003). These layoffs greatly interrupted the on-the-job knowledge and the continuity of work experience of Chinese female executives (Tan, 2008). As a consequence, at the individual level, females in China may not have had the same opportunities as males to invest and build human and relational capital, and may be less likely to be recognized and rewarded for the personal capability improvement (Cooke, 2003; Leung, 2003; Liu & Jia, 2017; Tan, 2008). For these reasons, we contend that female leaders face more barriers compared to male leaders in China, which leads to the following hypothesis.

Hypothesis 5 Female CEOs are less likely than male CEOs to achieve similar structural power in Chinese listed firms.

Previous studies show that investments in human and relational capital significantly reduce gender gaps (e.g., Chi & Li, 2008; Liu et al., 2000; Lyness & Thompson, 1997; Powell, 1999) and increase females' probability of gaining access to authority in the workplace (Muller-Kahle & Schiehll, 2013; Smith, 2002, 2012). For example, Liu et al. (2000) and Chi and Li (2008) found that human capital characteristics substantially bridge the wage gap between female and male employees in Chinese listed firms. Moreover, Song (2003) documented that formal education is able to increase Chinese female managers' power by preventing them from being replaced by males. Hillman, Cannella, and Harris (2002) and Singh et al. (2008) suggested that adequate experience helps women be appointed to more powerful positions. In the same line, Cooke (2003) and Chi and Li (2008) show that working experience improves managerial career opportunities for Chinese women, while predominant informal network systems (Allen et al., 2005; Xin & Pearce, 1996) may cause political ties and outside directorships in China to be far more important for female CEOs than males CEOs in obtaining structural power. This supports the view that female executives in China may need to leverage individual-level factors more than their male counterparts in order to reach similar structural power. This leads to the following research hypothesis:

Hypothesis 6 In Chinese listed firms, human and relational capital attributes, such as years of education, elite education, political ties, and directorships, increase the likelihood for female CEOs to have similar structural power as male CEOs.

Research methods

Data and sample

Due to the advantages of reducing unobserved heterogeneity, improving statistical causality, and controlling for both individual- and dynamic-level effects (Hitt, Gimeno, & Hoskisson, 1998; Lewellyn & Muller-Kahle, 2012; Muller-Kahle & Lewellyn, 2011), panel data have been used in our study and include Chinese listed firms on

either the Shanghai or Shenzhen A-Share Stock Exchange from 2010 to 2013.[5] The starting point for our sampling strategy is the Sinofin database developed by the Beijing University China Center for Economic Research (CCER), which is one of the most widely-used financial databases of Chinese listed firms.[6] The Sinofin corporate governance database provides information on 9,435 firm-year observations, including demographic data on 179,849 senior managers and information about the board of directors such as board size, CEO duality, and the percentage of independent directors on the board and firms' financial data including firm total assets, firm age, and past performance. The available demographic data on CEOs include gender, education background, work experience, job title, and board memberships. Similar to Kato and Long (2006) and Lam et al. (2013), we used the terms "General Manager" (*Zhong Jing Li*) and "Chief Executive Officer" (CEO) (*Zongcai* or *Shouxi Zhixingguan*) to identify the leading executive position in our sample firms, which the Chinese call "CEO." As shown in Table 1, missing data from 151 firms reduced our sample to 9,284 observations. We then eliminated 696 observations from firms operating in the financial sector based on the 2-digit Global Industry Classification Standard (GICS) code due to specialized high-leverage operations and specific regulation environments (Fama & French, 1992). We also excluded firms that went public (initial public offerings/IPOs) within one year and firms that underwent CEO turnover, as information on past performance was missing or the power of newly appointed CEOs was considered unstable (Haynes & Hillman, 2010). Our final sample comprises 6,545 firm-year observations, which includes 2,284 firms.

Variable measurement

Dependent variable

Table 2 summarizes the variables used in our empirical analysis. *Structural power* is the dependent variable which is a binary variable indicating whether a CEO also holds the position of chairperson of the board of directors and was termed CEO duality. This variable has been applied as a measure of structural power by many scholars (e.g., Daily & Johnson, 1997; Finkelstein, 1992; Lewellyn & Muller-Kahle, 2012; Muller-Kahle & Schiehll, 2013). Board chair in Chinese listed firms is "generally involved in the company's daily decision making," and "if both the chairman and the general manager are responsible for a company's daily operations, the chairman is considered to be more powerful than the general manager," as argued by Kato and Long (2006: 803). Therefore, CEO duality is assumed to provide the CEO with ultimate structural power as well as complete authority over the firm (Finkelstein, 1992; Finkelstein, Hambrick, & Cannella, 2009). To avoid potential endogeneity issue, the dependent variable was calculated using values one year after the independent variables.

[5] In order to avoid the influence of the subprime crisis, we follow the definition given by the National Bureau of Economic Research (NBER) and start our sample from 2010. Available at http://www.nber.org/cycles.html.
[6] Sinofin database has been used by many papers, such as Kato and Long (2006), Wu, Xu, and Phan (2011) and Cao et al. (2011).

Table 1 Sample description

Sample selection procedure	Obs.
1. Total number of firms listed on the Shanghai and Shenzhen A-Share Stock Exchange at December 31, 2010–2013 in the Sinofin Database;	9,435
2. Drop firms with missing data;	(151)
3. Drop firms in financial industry, based on 2-digit GICS code;	(696)
4. Drop IPOs and firms that underwent CEO turnover in 2010–2013.	(2,043)
Final sample size:	6,545

Independent variables

We include five variables capturing elements of the CEO's human capital. The first is *Years of education*. Similar to Datta and Guthrie (1994) and Muller-Kahle and Schiehll (2013), we use the natural logarithm[7] of the number of years of formal education, coded as follows: less than high school graduation equals nine years, high school graduation equals 12 years, Bachelor's degree equals 16 years, Master's degree equals 18 years, and PhD degree equals 22 years. *Elite education* is a dummy variable which takes on the value of one when the CEO graduated from either a Chinese or a foreign *Ivy League* university and zero otherwise. Elite Chinese universities belong to the C9 League, an alliance of nine outstanding universities. Together, they receive 10% of the national research spending and produce 20% of all academic publications and 30% of all citations in mainland China.[8] We consider elite foreign universities any of the eight Ivy League universities in the US, the U15 in Canada, the Russell Group in the UK, or the Go8 in Australia. Consistent with Lam et al. (2013), *Work experience* represents the number of years working in the current firm, and is measured by the natural logarithm of the number of years served in the firm.[9] We measure CEO's *Political ties* following Fan and Wong (2004) and Okhmatovskiy (2010), by creating a dummy that equals one if the CEO previously worked for the Chinese government or other SOE whose personnel were overseen by the Ministry of Human Resources and Social Security (MHRSS) and zero otherwise. Similar to Ma and DeDeo (2018), the variable

[7] *Years of education* is skewed in our sample, since 45% of CEOs have education lower than Bachelor.

[8] C9 League started from 2009 and includes Fudan University, Harbin Institute of Technology, Nanjing University, Peking University, Shanghai Jiao Tong University, Tsinghua University, University of Science and Technology of China, Xi'an Jiaotong University, and Zhejiang University. Data source: China Academic Degrees and Graduate Education Information Center. Available at http://www.cdgdc.edu.cn/xwyyjsjyxx/xwsytjxx/yxmd/274942.shtml.

[9] According to Kato and Long (2006: 804), Chinese database "provides data on the starting year of each CEO's current term, with a typical term for CEOs being 3 years in China, but fails to supply the year in which he or she is first appointed to the CEO position." We follow Kato and Long (2006) and obtain data on the total CEO tenure for those who serve more than a term from director's curriculum vitae. Since most of the senior managers in Chinese listed firms do not report working experience in the prior firms, so we can only trace back to their working experience in the focal firm.

Table 2 Variable definitions

Independent variable:	
Structural power	Dummy variable equal to 1 if the CEO is also the chairperson and 0 otherwise.
Dependent variables:	
Years of education	Natural log of years of education for the CEO: "less than high school" = 9 years, "high school" = 12 years, "Bachelor" = 16 years, "Master" = 18 years, and "PhD" = 22 years.
Elite education	Dummy variable equal to 1 if the CEO graduated from either a Chinese or foreign elite university and 0 otherwise. Chinese elite universities are those in the C9 League. Elite foreign universities are those in the Ivy League in the US, the U15 in Canada, the Russell Group in the UK, or the Go8 in Australia.
Work experience	Natural log of years the CEO has served in the focal firm.
Political ties	Dummy variable equal to 1 if the CEO used to work for the government or SOE and 0 otherwise.
Directorships	Natural log of number of firms where the CEO also serves as director.
Moderator:	
Gender	Dummy variable equal to 1 if the CEO is a female and 0 otherwise.
Control variables:	
Women directors%	The percentage of women directors to the total number of directors.
Founder	Dummy variable equal to 1 if the person is the firm's founder and 0 otherwise.
Cultural Revolution	Dummy variable equal to 1 if the person was born between 1948 and 1959.
Family ownership%	The percentage of CEO relatives' shareholding to the total number of shares.
SOE	Dummy variable equal to 1 if the ultimate controlling shareholder is a state asset management bureau, a state-owned enterprise (SOE) affiliated with the central government, or an SOE affiliated with the local government, and 0 otherwise.
Large shareholder wedge	The difference between the control rights and cash flow rights of the ultimate controlling shareholder.
Firm size	Natural log of firm's total assets.
Firm age	Natural log of years since the firm was created.
Past ROE	Net profit return/total equity in the past year.
Genviron	Average of the four indicators: (1) Governance: The relations between local government and market. (2) Finance: The maturity of the products market, including the competition of financial factors and marketization of credit allocation. (3) Intermediary: The service conditions of lawyers and certified public accountants, and the assistance level of industry associations given to enterprises. (4) Judiciary: The efficiency of judicial system and administrative executing departments.
Industry	Dummy variables representing 9 industries: Energy, Materials, Industrial, Consumer discretionary, Consumer staples, Health care, Utilities, Information technology, and Telecommunication services.

Directorships captures the CEO's outside network, measured as the natural logarithm[10] of the number of external firms where s/he serves as a board director. To test our research hypotheses on the determinants of CEO structural power in Chinese listed

[10] *Directorships* is skewed, since 52% of CEOs in our sample have 0 directorships.

firms and potential gender influence, we include *Gender* as another independent variable. This is a dichotomous variable that equals one if the CEO is female and zero if male.

Control variables

Consistent with previous literature, we include a number of control variables. As Lam et al. (2013) and Liu et al. (2014) showed, female CEOs are likely to be supported by other women directors on the board. Hence, we control for *Women directors%*, measured by the percentage of female directors within the total number of directors (i.e., board size). As Tan (2008) contended, when women face unfair barriers in their original organization, they tend to quit and start their own business, and subsequently become top management of their own companies. Accordingly, we control for *Founder*, using a dummy that equals one if the CEO is the firm's founder and zero otherwise. Because China halted university education from 1966 to 1977 (Fan & Wong, 2004; Liu & Jia, 2017), we created a *Cultural Revolution* dummy that equals one if the CEO was born between 1948 and 1959, such that when they were 18 years old and ready to graduate from high school, university education was unavailable.[11] Allen et al. (2005) found that in less developed Chinese financial markets, fundraising from the family greatly helps founders and managers acquire early-stage funds through private equity and loans. Hence, similar to Andres (2008), we control for *Family ownership%*, measured by the percentage of CEO relatives' shareholding to the total number of shares. Due to the government's dominant role in the Chinese capital market, we control for *SOE*. Similar to Cao, Pan, and Tian (2011), we create a dummy that equals one if the focal firm is a SOE.[12] Claessens, Djankov, and Lang (2000) reported that in Asia, controlling shareholders commonly create divergence between control rights (the right to vote) and cash-flow rights (the right to receive dividends) through ownership pyramids. The shareholding wedge by the largest shareholder tends to be inversely related to CEO power over the board (e.g., Cao et al., 2011; Claessens et al., 2000). Thus, we control for *Large shareholder wedge*, or the divergence between voting and cash-flow rights held by the ultimate controlling shareholder.[13] In line with Kato and Long (2006), Ye et al. (2010), and Lam et al. (2013), we also control for *Firm size*, *Firm age* and *Industry* (see measurement details in Table 2). Following Daily and Johnson (1997), good prior firm performance boosts a CEO's reputation and helps the CEO acquire higher structural power. We therefore consider *Past ROE*, measured by one-year lagged ROE (return on equity). Since firms tend to mimic each other and be influenced by the institutional environment, we follow Li and Tang (2010) and Zhou, Tam, and Lan (2016) and control for the quality of the governance environment

[11] Our results are unchanged when we replace *Cultural Revolution* with CEOs' age. Since the Cultural Revolution has influenced the accessibility to education of some individuals born in a certain period, we expect that this variable is therefore more accurate than the CEO age to control the special historical effect in the Chinese context.

[12] The ultimate controlling shareholder is a state asset management bureau, an SOE affiliated with the central government, or an SOE affiliated with a local government. Ultimate controlling shareholders are the shareholders who directly or indirectly control more than 10% of the firm's voting shares (See more details in Claessens et al., 2000).

[13] It is worth noting that *Large shareholder wedge* is different from the BvD (Bureau Van Dijk) independence indicator, which represents the ownership concentration level used in our matching sample procedures.

(*Genviron*) of the provincial jurisdiction in which the firm's headquarter is located. The *Genviron* is a composite variable, measured by the average of four indicators: governance, finance, intermediary and judiciary (see measurement details in Table 2 and more details in Zhou et al., 2016). Following Haynes and Hillman (2010), outliers were checked and recorded as the highest value of non-outliers based on the normal distribution assumption.

Regression model

Following Muller-Kahle and Lewellyn (2011) and Lewellyn and Muller-Kahle (2012), we test our hypotheses using panel data logistical regression with random-effect estimation[14] by using the xtlogit commands in STATA 14. The following justifies our estimation method: our dependent variable, CEO structural power, is a binary variable; our sample is longitudinal, not every firm exists in all years of the panel; and many of the independent variables (e.g., CEOs' education level and gender) are relatively stable overtime.

Results

Descriptive statistics

Descriptive statistics of all variables for the full sample are presented in Table 3. Table 3 Panel A shows that 24% of CEOs in Chinese listed firms also held the board chair position. This contrasts with the 13% CEO duality from 2000 to 2008 in McGuinness et al. (2015) and 16% from 1999 to 2011 in Liu et al. (2014). In addition, 5.9% of the CEOs in our sample are female. This shows an increase in the proportion of female CEOs, when compared with previous studies: 4.4% from 2000 to 2008 (Lam et al., 2013; McGuinness et al., 2015; Ye et al., 2010), and 5% from 1999 to 2011 (Liu et al., 2014). Our data therefore indicate that both CEO duality and the number of female CEOs in China have been increasing significantly in recent years.[15]

Panel A, Table 3 also shows that the CEOs in our sample have an average of 13.3 years of formal education, which is much less than the years required to obtain a Bachelor's degree (16 years), and that only 48.4% (not reported) have a university degree. These results concur with Fan and Wong (2004) and Liu et al. (2014). Moreover, 7.2% of CEOs in our sample graduated from elite universities, representing lower levels when compared to CEOs in the US.[16] Twenty percent of CEOs in our sample have *Political ties*, which is consistent with Fan and Wong (2004). On average, 1.8% of the CEOs are founders of the focal firm. Only 23.4% of CEOs in our sample were born during the Cultural Revolution period. Of the firms in our sample, 45.5% are controlled by the government

[14] Based on the Hausman test, the random-effect model is more preferred than the fixed-effect model to test our sample.

[15] Those results are significant at 1% level in the sample period based on the LSD tests. All the results not reported in this paper are available from the authors.

[16] See, for example, the study by Muller-Kahle and Schiehll (2013) based on CEOs in the US.

Table 3 Descriptive statistics and comparisons between female and male CEOs in our sample

Panel A: Dummy and categorical variables

	Full sample ($n = 6{,}545$)				Female CEOs ($n = 387$)	Male CEOs ($n = 6{,}158$)	
	Min	Max	Mean	SD	Mean	Mean	χ^2
Structural power	0	1	.240	.427	.200	.240	3.364*
Years of education[a]	9	22	13.341	4.349	13.726	13.317	13.986***
Elite education	0	1	.072	.258	.078	.071	.212
Political ties	0	1	.200	.400	.196	.201	.043
Gender (Female = 1)	0	1	.059	.236	–	–	
Founder	0	1	.018	.134	.031	.017	3.790*
Cultural Revolution	0	1	.234	.424	.233	.234	.008
SOE	0	1	.455	.498	.287	.466	47.000***

Panel B: Continuous variables

	Full sample				Female CEOs	Male CEOs	
	Min	Max	Mean	SD	Mean	Mean	*t-Stat*
Work experience[a]	1	41	6.265	5.150	6.863	6.228	2.355**
Directorships[a]	0	37	1.567	2.927	1.793	1.553	1.569
Women directors%	0	.600	.124	.115	.240	.117	21.175***
Family ownership%	0	.739	.023	.103	.057	.021	6.669***
Large shareholder wedge	0	.632	.049	.082	.041	.049	−1.986**
Firm size	13.763	28.282	21.666	1.291	21.359	21.686	−4.829***
Firm age[a]	1	33	13.703	5.110	13.535	13.714	−.669
Past ROE	0	.438	.093	.104	.099	.093	1.169
Genviron	2.320	9.620	7.288	1.452	7.248	7.290	−.554

[a] Before logarithm transformation. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. *Structural power* Dummy variable indicating whether the CEO is also the chairperson; *Years of education* Years of education for the CEO: "less than high school" = 9 years, "high school" = 12 years, "Bachelor" = 16 years, "Master" = 18 years, and "PhD" = 22 years; *Elite education* Dummy indicating whether the CEO is graduated from either a Chinese or foreign elite university; *Working experience* Years the CEO has served in the firm; *Political ties* Indicates whether the CEO used to work for the government or SOE; *Directorships* Number of firms where the CEO also serves as director; *Gender* Dummy indicating whether the CEO is a female; *Women directors%* Percentage of women directors on board; *Founder* Dummy indicating whether the CEO is the firm's founder; *Cultural Revolution* Indicates whether the CEO was born between 1948 and 1959; *Family ownership%* Percentage of CEO relatives' shareholding; *SOE* Dummy representing whether the firm is controlled by the government; *Largest shareholder wedge* Difference between the control rights and cash flow rights of the ultimate controlling shareholder; *Firm size* Log of firm's total assets; *Firm age* Years since the firm's establishment; *Past ROE* ROE in the past year; *Genviron* Index of the governance environment

(SOEs). Jiang and Kim (2015) showed that, in 1999, the state was the largest shareholder of 85.8% of Chinese listed firms. This percentage dropped to 47% by 2012.

Table 3, Panel B shows that our mean value for *Work experience* is 6.3 years.[17] Thirty-nine point five seven percent of the CEOs have at least one outside directorship

[17] The average CEO tenure in McGuinness et al. (2015) sample is around 2.8 years, which measures the tenure of each CEO's current term (normally 3 years) and therefore it is not directly comparable to our measure.

(not reported), with a maximum of 37, suggesting that CEO interlocking is common practice in Chinese listed firms. The proportion of *Women directors%* is on average 12.4%, which is consistent with Liu et al. (2014) which reports that from 1999 to 2011, 10.2% of directors in Chinese listed firms were female. On average, CEOs' relatives control 2.3% of the shareholdings of their focal firms. The average *Large shareholder wedge* is 4.9%, whereas in Cao et al. (2011), in a sample of Chinese listed firms from 2002 to 2007, the large shareholder wedge is 6.4%.[18] Firm size, firm age and past performance in our sample are also comparable to those in prior studies (e.g., Cao et al., 2011; Liu et al., 2014; McGuinness et al., 2015).

Table 3 also compares descriptive statistics by subgroups: firms with a female CEO and firms with a male CEO. The main variables are compared using either χ^2 test or *t*-tests of differences,[19] respectively. *Structural power*, *Years of education*, *Founder*, *SOE*, *Work experience*, *Women directors%*, *Family ownership%*, *Large shareholder wedge*, and *Firm size* show significant differences between the female and male CEO subgroups. As expected, female CEOs are less likely than male CEOs to hold the board chair position, our proxy for CEO structural power. However, female CEOs have human capital that is equal to or greater than male CEOs. Female CEOs are more likely to have more years of education and more *Work experience* than male CEOs. More female than male CEOs are founders, and are more likely to work in non-SOE firms with higher level of *Women Directors%* on the board, have a lower level of *Large shareholder wedge*, have more *Family ownerships%* and have a smaller *Firm size*, consistent with Lam et al. (2013) and Liu et al. (2014).

The correlation matrix shown in Table 4 indicates that the correlations among independent variables are far below .5, indicating the absence of potential multicollinearity among variables. To test for multicollinearity, for all regression models, variance inflation factors (VIFs) for the independent and control variables were calculated and are far below the suggested value of 10, ranging from 1.01 to 1.48, indicating the absence of potential multicollinearity problems. In Table 4, all of the human capital attributes, except for *Political ties*, are positively associated with CEO structural power, while *Gender* again is negatively associated with CEO structural power. Overall, these findings indicate that human capital attributes help CEOs obtain structural power, while female CEOs have less structural power than male CEOs, and that there are certain demographic differences that distinguish female and male CEOs.

Regression results

Table 5 presents the results of the panel data logistical regressions using CEO structural power as the dependent variable. Model 1 includes control variables only. To address our first research question concerning the human capital attributes that explain CEO structural power (H1–H4) and the hypothesis on the greater barriers for female compared to male CEOs in obtaining structural power (H5), we estimate Model 2, which includes all independent variables of interest and the control variables. As

[18] The decreasing trend for the large shareholder wedge and number of SOEs could be explained by recent economic reforms and privatizations in China (Jiang & Kim, 2015).

[19] Following Norušis (2006), the binary and categorical variables are compared using χ^2 test, and continuous variables are compared using *t*-test.

Table 4 Pearson correlation matrix for CEOs in Chinese listed firm(s) (Full sample: $n = 6{,}545$)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Structural power	1															
2. Years of education	.129***	1														
3. Elite education	.091***	.300***	1													
4. Work experience	.120***	.111***	.088***	1												
5. Political ties	−.006	−.017	−.012	.034***	1											
6. Directorships	.196***	.106***	.062***	.114***	−.042***	1										
7. Gender	−.023*	.028**	.006	.032**	−.003	.017	1									
8. Women directors%	.077***	.018	.008	.016	.013	.023*	.253***	1								
9. Founder	.124***	.071***	.100***	.079***	.026**	.031**	.024*	.048***	1							
10. Cultural Revolution	.038***	−.124***	−.080***	.057***	.004	−.017	−.001	.027**	−.013	1						
11. Family ownership%	.085***	.081***	.049***	.072***	−.016	.044***	.082***	.088***	.076***	−.040***	1					
12. SOE	−.301***	−.148***	−.118***	−.144***	−.005	−.144***	−.085***	−.167***	−.115***	.103***	−.193***	1				
13. Large shareholder wedge	−.039***	−.023*	−.008	−.084***	.014	.056***	−.025**	−.010	−.020	.014	−.095***	−.096***	1			
14. Firm size	−.167***	−.020	.031**	.023*	−.002	.054***	−.060***	−.159***	−.037***	.080***	−.092***	.360***	.049***	1		
15. Firm age	−.129***	−.217***	−.087***	−.027**	.048***	−.143***	−.014	−.012	−.058***	.075***	−.158***	.244***	.032***	.045***	1	
16. Past ROE	−.014	.016	.011	−.014	.003	.001	.014	−.004	.009	.007	−.018	.014	.039***	.076***	.058***	1
17. Genviron	.095***	.038***	.081***	.080***	.008	.143***	−.007	.040***	.022*	.013	.060***	−.182***	−.014	−.029**	−.076***	.003

*, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. *Structural power* Dummy variable indicating whether the CEO is also the chairperson; *Years of education* Log of years of education for the CEO; *Elite education* Indicates whether the CEO is graduated from either a Chinese or foreign elite university; *Working experience* Log of years the CEO has served in the firm; *Political ties* Indicates whether the CEO used to work for the government or SOE; *Directorships* Log of the number of firms where the CEO also serves as director; *Gender* Indicates whether the CEO is a female; *Women directors%* Percentage of women directors on board; *Founder* Dummy indicating whether the CEO is the firm's founder; *Cultural Revolution* Indicates whether the CEO was born between 1948 and 1959; *Family ownership%* Percentage of CEO relatives' shareholding; *SOE* Represents whether the firm is controlled by the government; *Largest shareholder wedge* Difference between the control rights and cash flow rights of the ultimate controlling shareholder; *Firm size* Log of firm's total assets; *Firm age* Log of years since the firm's establishment; *Past ROE* ROE in the past year; *Genviron* Governance environment

Table 5 Logistic regressions for CEOs in Chinese listed firm(s) (Full sample: $n = 6{,}545$)

DV:		Model 1			Model 2			Model 3		
		Structural power			Structural power			Structural power		
Exp. Sign		*B*	SE	*p*	*B*	SE	*p*	*B*	SE	*p*
Constant		1.519	.717	.034**	2.818	.744	.000***	2.815	.744	.000***
Women directors%	+	.327	.264	.215	.597	.279	.032**	.622	.280	.026**
Founder	+	1.116	.201	.000***	1.035	.209	.000***	1.065	.210	.000***
Cultural Revolution	−	.504	.073	.000***	.560	.076	.000***	.553	.076	.000***
Family ownership%	+	.064	.253	.801	.032	.258	.902	.045	.259	.861
SOE	−	−1.392	.080	.000***	−1.263	.082	.000***	−1.261	.082	.000***
Large shareholder wedge	−	−1.900	.414	.000***	−2.057	.427	.000***	−2.008	.428	.000***
Firm size	−	−.129	.029	.000***	−.193	.030	.000***	−.193	.030	.000***
Firm age	−	−.261	.065	.000***	−.123	.069	.074*	−.125	.069	.070*
Past ROE	+	−.028	.310	.928	.000	.320	.999	.036	.320	.912
Genviron	+	.072	.023	.002***	.030	.024	.202	.030	.024	.217
Direct effects:										
Years of education	H1(+)				.272	.055	.000***	.265	.055	.000***
Elite education	H1(+)				.217	.117	.064*	.209	.118	.075*
Work experience	H2(+)				.152	.042	.000***	.155	.042	.000***
Political ties	H3(+)				.022	.079	.786	.025	.080	.751
Directorships	H4(+)				.500	.041	.000***	.497	.041	.000***
Gender	H5(−)				−.676	.144	.000***	−.769	.164	.000***
Interaction terms:										
Gender × Years of education	H6(+)							−.588	.255	.210
Gender × Elite education	H**6**(+)							.700	.482	.146
Gender × Work experience	H**6**(+)							.030	.202	.884
Gender × Political ties	H**6**(+)							−.186	.377	.621
Gender × Directorships	H**6**(+)							.444	.171	.009***
Log likelihood/Model χ^2		−3,188.60/675.80 ($p = .000^{***}$)			−3,068.56/836.98 ($p = .000^{***}$)			−3,061.67/846.55 ($p = .000^{***}$)		
$\Delta\chi^2$ (vs Model 1)					240.07 ($p = .000^{***}$)			253.85 ($p = .000^{***}$)		
$\Delta\chi^2$ (vs Model 2)								13.78 ($p = .017^{**}$)		

Industry dummies and year fixed effect included in models, but not reported. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. *Structural power* Dummy variable indicating whether the CEO is also the chairperson; *Years of education* Log of years of education for the CEO: "less than high school" = 9 years, "high school" = 12 years, "Bachelor" = 16 years, "Master" = 18 years, and "PhD" = 22 years; *Elite education* Dummy indicating whether the CEO is graduated from either a Chinese or foreign elite university; *Working experience* Log of years the CEO has served in the firm; *Political ties* Indicates whether the CEO used to work for the government or SOE; *Directorships* Log of the number of firms where the CEO also serves as director; *Gender* Dummy indicating whether the CEO is a female; *Women directors%* Percentage of women directors on board; *Founder* Dummy indicating whether the CEO is the firm's founder; *Cultural Revolution* Indicates whether the CEO was born between 1948 and 1959; *Family ownership%* Percentage of CEO relatives' shareholding; *SOE* Dummy representing whether the firm is controlled by the government; *Largest shareholder wedge* Difference between the control rights and cash flow rights of the ultimate controlling shareholder; *Firm size* Log of firm's total assets; *Firm age* Log of years since the firm's establishment; *Past ROE* ROE in the past year; *Genviron* Index of the governance environment

expected, Model 2 has higher explanatory power than Model 1, with a significant improvement between Model 1 to Model 2 ($\Delta\chi^2 = 240$, $p < 1\%$). Table 5, Model 2 shows that *Years of education* ($b = .27$, $p < 1\%$), *Elite education* ($b = .22$, $p < 10\%$) and *Work experience* ($b = .15$, $p < 1\%$) show strong positive associations with CEO structural power, supporting H1 and H2 concerning human capital attributes. *Political ties* has an insignificant association with CEO structural power, providing no support for H3, but CEO's *Directorships* ($b = .5$, $p < 1\%$) shows a significant and positive association with CEO structural power, which supports our H4. As expected, *Gender* shows significant and negative coefficient ($b = -.68$, $p < 1\%$), supporting H5 that female CEOs are less likely than their male counterparts to gain structural power.

In order to further investigate whether this gender effect (H6) impacts the relationships between CEO's human capital and the probability to gain structural power, we built interaction terms between the *Gender* and the human capital variables in Model 3 (Table 5). Following Cohen, Cohen, West, and Aiken (2003), the independent variables were mean centered to decrease the potential multicollinearity. As expected, Model 3 has significantly higher explanatory power than Model 1 ($\Delta\chi^2 = 253.9$, $p < 1\%$) and Model 2 ($\Delta\chi^2 = 13.8$, $p < 5\%$). Interaction terms between *Gender* and *Years of education*, *Elite education*, *Work experience* and *Political ties* show insignificant coefficients, suggesting higher levels of human capital in these attributes do not increase the probability of female CEOs attaining *Structural power*. We interpret these results as evidence that these attributes are not enough to mitigate the gender inequality from a leadership perspective in our sample. However, the interaction term *Gender* with *Directorships* ($b = .44$, $p < 1\%$) is significantly positive, suggesting that CEO's outside directorships are the only attribute that mitigates gender inequality in Chinese listed firms.

To better visualize gender differences in the relationship between CEO's human capital attributes and structural power documented in Table 5 Model 3, and consistent with Hoetker (2007) we estimate the probabilities of female and males CEOs obtaining the structural power. These probabilities are presented in Table 6.[20] Holding all other variables constant at their mean values (see more details in Folta & O'Brien, 2004; Hoetker, 2007; Long, 1997), *Years of education* increase the probability of male CEOs to obtain structural power from 17 to 26%, while it appears to be detrimental for female CEOs in our sample, as the probability decreases from 13 to 8%. In contrast, *Elite education* greatly improves the probability of female CEOs obtaining structural power (from 10 to 21%), but not as much as the probability for male CEOs with *Elite education* (23%) to obtain similar structural power. This also suggests that *Elite education* can help female CEOs to obtain structural power only if compared with male CEOs without *Elite education*. As *Work experience* increases from 1 to 30 years, the probability of both female and male CEOs obtaining structural power increases, but again the effect is greater for male CEOs. In other words, with similar level of work experience, the likelihood of obtaining structural power is always higher for male CEOs than for female CEOs.

[20] The results only include independent variables with significant direct effects on the dependent variable.

Table 6 Probabilities of CEO structural power

Variables:	Probability (Structural power = 1)		
Years of education	Female	Male	Difference
Lower	12.6%	17.4%	−4.8%
High School	10.6%	20.6%	−10.0%
Bachelor	9.5%	22.7%	−13.1%
Master	8.9%	24.2%	−15.4%
PhD	8.3%	25.5%	−17.1%
Elite education	Female	Male	Difference
0	10.1%	20.3%	−10.2%
1	21.1%	23.1%	−2.1%
Work experience	Female	Male	Difference
1	8.3%	16.9%	−8.6%
5	10.8%	20.6%	−9.9%
10	12.1%	22.4%	−10.4%
20	13.5%	24.3%	−10.9%
30	14.4%	25.5%	−11.1%
Directorships	Female	Male	Difference
0	6.5%	16.3%	−9.8%
1	11.6%	21.2%	−9.7%
5	26.3%	31.1%	−4.8%
10	38.4%	37.6%	.8%
15	46.7%	41.8%	4.9%

Calculated at the mean values of all variables based on the logistic regressions in Table 5 Model 3. *Structural power* Dummy variable indicating whether the CEO is also the chairperson; *Years of education* Years of education for the CEO: "less than high school" = 9 years, "high school" = 12 years, "Bachelor" = 16 years, "Master" = 18 years, and "PhD" = 22 years; *Elite education* Dummy indicating whether the CEO is graduated from either a Chinese or foreign elite university; *Working experience* Years the CEO has served in the firm; *Political ties* Indicates whether the CEO used to work for the government or SOE; *Directorships* Number of firms where the CEO also serves as director

As the number of directorships increases, the probability of CEOs obtaining structural power increases significantly for both females and males. The probability of female CEOs with no directorships to obtain structural power is only 7%, much lower than the probability of male CEOs (16%) under the same conditions. More importantly, with 10 directorships, the probability of female CEOs obtaining structural power exceeds male CEOs with similar level of directorships. Although not reported, holding all other variables constant at the mean, the difference between female and male CEOs obtaining structural power in our sample becomes insignificant when the CEO has at least one directorship. To further illustrate the gender differences documented by the results of Table 5, Model 3 and Table 6, we plot the 95% confidence intervals[21] of the relationship between *Directorships* and *Structural power* for the female and male subgroups

[21] We thank one of the reviewers for this suggestion.

(see more details in Hoetker, 2007; Long, 1997). Figure 1 shows that *Directorships* increase the structural power of both female and male CEOs, but the influence is stronger for females than males, and the confidence intervals begin to overlap only after the CEO's directorships reach a certain level, indicating that with around four directorships, the probability of female CEOs obtaining structural power becomes indifferent from male CEOs. This suggests that outside directorships is the only attribute capable to mitigate gender inequality at the executive level in Chinese listed firms. We interpret this evidence as additional support to H6.

Overall, our results suggest that human capital attributes such as years of education, elite education and work experience, are important determinants of CEO structural power in Chinese listed firms. They increase the likelihood of CEOs obtaining structural power, but are not able to mitigate the gender inequality. Although not tabulated, it is worth noting that in our sample the average age of CEOs is 48.6 years old, with 75% born after 1960 and 32% born after 1965, and thereby showing a significant decreasing trend of CEOs whose access to university would have been affected by the *Cultural Revolution*. This suggests that contrary to the argument in Fan and Wong (2004), the Chinese Cultural Revolution would not be the main explanation for the low level of formal education among Chinese CEOs in our sample, given that the *Cultural Revolution* influenced mainly people who were born before 1960. Again, although not tabulated, we find that as years of education increases, the probability of female obtaining structural power decreases. After tracing back to the data, we find that as the level of education increases, the number of directorships of female CEOs declines drastically, while the directorships for male CEOs increases. Since directorships are expected to play a far more important role to improve female CEOs' structural power in the Chinese context, we interpret this as evidence that too much education may cause opportunity costs in deterring female CEOs' opportunities to gain multiple directorships, and females may supplement their deficiency in formal education with stronger external directorships. These findings concur with Xin and Pearce (1996), Fan and Wong (2004), Allen et al. (2005), and You and Du (2012), about the key role of relational capital in China in the appointment and promotion of top management. Although not tabulated, it is worth noting that, in our sample, female CEOs are significantly younger than male CEOs, and the age gap between CEOs and chairpersons is significantly larger when the CEO is female.[22] This significant age gap suggests that female CEOs work under the supervision of more experienced and powerful board chairs, which echoes the argument by Jiang and Kim (2015).

Robustness checks

Given the relatively small number of female CEOs in our sample and the potential differences in their organizations when compared with male CEOs, we built a matching pair sample by pairing firms with a female CEO to comparable firms with a male CEO. Lyness and Thompson (1997) suggested that matched samples are useful for examining gender issues as it allows better control for potential organizational-level differences. Similar approaches are used by Judge, Gaur, and Muller-Kahle (2010) and Muller-

[22] Those results are significant at 1% level in the sample period based on the *t*-statistic tests.

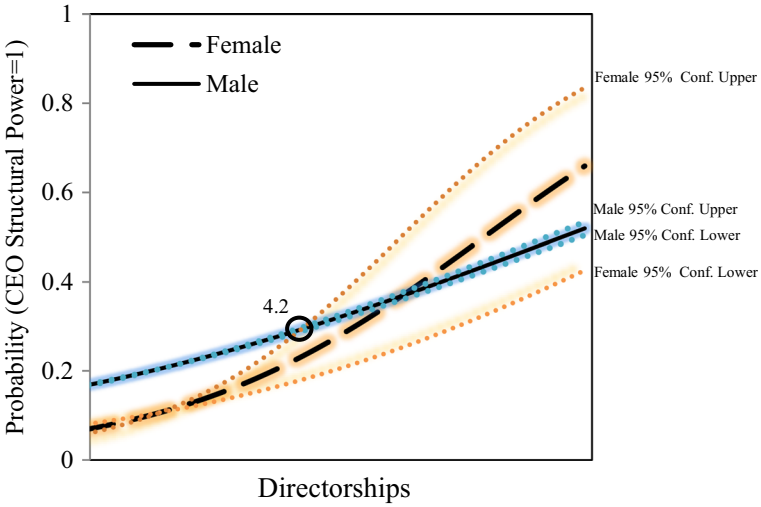

Fig. 1 Influence of the interaction between CEO directorship and gender on CEO structural power under 95% confidence interval

Kahle and Schiehll (2013). Hence, we matched each female CEO to a male CEO whose firm (1) operates in a similar industry, (2) has similar ownership concentration (BvD independence indicator),[23] (3) has the same type of controlling shareholder (state, family, foreign, or financial institution), and (4) has similar size (±25% range of total assets). The results are a final matched sample of 774 observations, 387 female with 387 male CEOs.

We first examine the descriptive statistics of the matching pair sample (Table 7, Panel A), followed by a random-effect logistical regression analysis[24] using the matching pair sample (Table 7, Panel B). We compare the main variables between the two subgroups and, as expected, no significant differences are found between the two subgroups with respect to the four matching criteria. Consistent with our main analysis, reported in Table 5, female CEOs are less likely than male CEOs to hold the board chair position, our proxy for CEO structural power. Table 7, Panel B, presents three panel data logistical regression models based on the matching pair sample (Model 1) and the female and male CEO subgroups (Models 2 and 3), respectively, with CEO *Structural power* as the dependent variable. In Model 1, *Gender* is again negatively associated with CEO *Structural power*, supporting our main results in Table 5. *Years of education*, *Elite education*, *Work experience* and *Directorships* again show significantly positive coefficients in Model 1, Table 7, again consistent with our main results. In

[23] We collected the the BvD Independence Indicator from the Bureau Van Dijk's (BvD) ORBIS database. Bureau Van Dijk's (BvD) independence indicator: "The BvD Independence Indicator categorizes the degree of independence of a company; it is not a rating. This indicator excludes the following owners from consideration when determining status of independence: Public, Mutual Funds, Private shareholders (more than one unnamed individual), and Bulk list of shareholders (more than one unnamed shareholder, but containing a mixture of companies and individuals)" (Orbis User Guide, 2017). Available at https://help.bvdinfo.com/mergedProjects/68_EN/Home.htm.

[24] Based on the Hausman test, the random-effects model is more preferred than the fixed-effects model to test our sample.

Table 7 Descriptive statistics and logistic regressions using the matching pair sample

Panel A: Descriptive statistics for CEOs in the matching pair sample.

	Female CEOs ($n = 387$)		Male CEOs ($n = 387$)		
	Mean	SD	Mean	SD	χ^2
Structural power	.202	.402	.315	.465	13.053***
Elite education	.078	.268	.072	.259	.075
Political ties	.196	.398	.233	.423	1.503
	Mean	SD	Mean	SD	*t-Stat*
Years of education[a]	13.726	4.167	13.401	4.215	1.081
Work experience[a]	6.863	5.681	6.558	4.659	.816
Directorships[a]	1.793	3.289	1.708	2.553	.403

Panel B: Logistic regressions for CEOs in the matching pair sample.

Sample: DV:	Model 1 Matching Pair Structural power			Model 2 Female CEOs Structural power			Model 3 Male CEOs Structural power		
	B	SE	*p*	*B*	SE	*p*	*B*	SE	*p*
Constant	−2.593	.617	.000***	−4.645	2.665	.081*	−3.032	.855	.000***
Years of education	.061	.023	.009***	−.038	.068	.578	.107	.032	.001***
Elite education	.751	.316	.017**	.459	1.415	.082*	.346	.453	.446
Work experience	.063	.016	.000***	.062	.051	.223	.097	.027	.000***
Political ties	−.097	.220	.658	−.314	.669	.639	−.017	.289	.954
Directorships	.154	.029	.000***	.293	.145	.044**	.140	.046	.002***
Gender	−.880	.202	.000***						
Control variables	Included			Included			Included		
Log likelihood	−392.27			−172.66			−206.97		
Model χ^2	83.88 ($p = .000$***)			4.60 ($p = .970$)			49.48 ($p = .000$***)		
Obs.	774			387			387		

[a] Before logarithm transformation. Control variables and year fixed effect included in models, but not reported. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively. *Structural power* Dummy variable indicating whether the CEO is also the chairperson; *Years of education* Log of years of education for the CEO: "less than high school" = 9 years, "high school" = 12 years, "Bachelor" = 16 years, "Master" = 18 years, and "PhD" = 22 years; *Elite education* Dummy indicating whether the CEO is graduated from either a Chinese or foreign elite university; *Working experience* Log of years the CEO has served in the firm; *Political ties* Indicates whether the CEO used to work for the government or SOE; *Directorships* Log of the number of firms where the CEO also serves as director; *Gender* Dummy indicating whether the CEO is a female

Models 2 and 3, Table 7, *Elite education* improves CEO structural power only for females, while *Years of education* and *Work experience* improve CEO structural power only for males, which seems consistent with the analysis of differences in probabilities, as suggested by Hoetker (2007), and presented in our Table 6. The coefficient of outside *Directorships* is again positive in all three models, but has a stronger positive effect on female CEO structural power (Model 2). Overall, the regression results with the matching pair sample corroborate our main results reported in Table 5.

A second concern is that CEO structural power could result from factors other than CEO duality. For instance, ownership could be another source of CEO

power (Daily & Johnson, 1997; Finkelstein, 1992; Haynes & Hillman, 2010; Lewellyn & Muller-Kahle, 2012). Similar to Haynes and Hillman (2010), we use CEO relative to board shareholdings as an alternative measure of CEO power. Accordingly, we construct a CEO power composite variable based on CEO duality and CEO/board ownership (CEO relative to board equity holdings). These two variables are standardized and summed, and the Cronbach's (1951) alpha is .57. Our results with this alternative measure of CEO power are qualitatively similar to our main results. However, it is worth noting that as reported by Jiang and Kim (2015), different from Western countries, CEOs as well as directors and other senior managers in China are less likely to obtain shares of their firms, with the average of shareholding percentage is close to 0% from 1999 to 2012.[25] Therefore, we contend that CEO ownership might not be as important as in Western firms, to capture CEO structural power in Chinese listed firms. As suggested by Haynes and Hillman (2010) and Lewellyn and Muller-Kahle (2012), board independence (the ratio of independent directors on the board) could also be a dimension of CEO structural power, because boards with a high ratio of independent directors would monitor CEOs intensively, thereby negatively influencing CEO power. In our sample, however, board independence is positively correlated with CEO duality (.06),[26] reflecting the fact that in firms where the CEO is also the board chair, the board has a higher proportion of independent directors. In line with this literature, and as summarized in Table 8, board independence begins to correlate positively with CEO duality after 2003, when the China Securities Regulatory Commission (CSRC-102, 2001) required listed firms in China to have boards composed of one-third independent directors. Thus, we view board independence as reflecting institutional pressure instead of the real effect of CEO relative to board power in Chinese listed firms, concurring with Jiang and Kim (2015).[27]

As Finkelstein (1992), Peng et al. (2015) and van Essen et al. (2015) argued, CEO compensation could be another indicator of CEO power, since CEOs with higher power over the board may attempt to maximize their compensations. In our sample, however, the correlation between CEO compensation (CEO relative to board compensation) and CEO duality is insignificant, and more than 3% of CEOs and 25% of directors in our sample did not receive compensation from the focal firms. Consistent with Hu, Tam, and Tan (2010), this evidence suggests that in Chinese listed firms, large shareholders appoint their representatives as CEOs or directors, and also provide their compensation. For example, Hu et al. (2010) reported that 17% directors in their sample directly receive compensation from large shareholders, suggesting that compensation may not capture CEOs' and directors' real income. In the same line, Jiang and Kim (2015)

[25] Given space constraints, the results are not tabulated here, but are available upon request.

[26] This positive correlation between CEO duality and board independence is consistent with other studies of Chinese listed firms (e.g., Conyon & He, 2011; Liu et al., 2014; McGuinness et al., 2015) using data after 2003.

[27] We used the term "Director" (*Dongshi*) to identify directors, excluding those who resigned in 2013 in the SinoFin executive database. We used the term "Independent Director" (*Duli Dongshi*) to identify independent directors in the SinoFin executive database, in which the original data come from firms' annual reports and the definition of "Independent Director" follows CSRC (2001), Guiding opinions on establishing the independent director institution in listed companies. Available at http://www.csrc.gov.cn/pub/csrc_en/newsfacts/release/200708/t20070810_69191.html.

Table 8 Previous studies on CEO duality/board independence correlations in Chinese listed firms

Author(s)	Journal	Definition of independent director	Correlation	Significance	Sample period	Data source
Tian and Lau (2001)	APJM	Directors who are not employed by the focal shareholding company or its subsidiaries	−.15	Unknown	1996	IPO statements
Firth, Fung, and Rui (2007)	JAPP	Independent non-executive directors	−.035	$p < 10\%$	1998–2003	CSMAR
Conyon and He (2011)	JCF	Directors hold "independent director" job title in Sinofin	.01	Unknown	2001–2005	Sinofin
Liu et al. (2014)	JCF	Directors hold "independent director" job title in CSMAR	.02	Unknown	1999–2011	CSMAR
McGuinness et al. (2015)	APJM	Directors hold "independent director" job title in CSMAR	.027	Unknown	2000–2008	CSMAR

APJM Asia Pacific Journal of Management; *JAPP* Journal of Accounting and Public Policy; *JCF* Journal of Corporate Finance

showed that CEOs and directors of SOEs are more like government officers rather than professional managers, and, thus, getting promoted is somewhat more important for them than raising compensation. Consistent with this evidence, we contend that compensation may not be an appropriate way to measure structural power of CEOs in Chinese listed firms.

Previous studies also indicate that Chinese SOEs behave differently from non-SOEs (e.g., Cao et al., 2011; Jiang & Kim, 2015). As reported above, our sample contains significantly more female CEOs in non-SOEs than SOEs. Therefore, as an additional robustness test, we run the models only with non-SOEs (3,566 firm-years observations). Qualitatively, our results again indicate that in non-SOEs, female CEOs have less structural power than male CEOs, and in terms of human capital attributes examined, the results are again qualitatively similar to our main results. This suggests that our results are still robust to potential differences in the upward mobility between SOEs and non-SOEs.

Discussion

The objective of this study is to examine the human and relational capital attributes that enable CEOs to acquire structural power in Chinese listed firms, and whether gender intervenes in the capability of these attributes in explaining CEO structural power. Drawing on human capital theory (Becker, 1964, 1971), we hypothesize that CEOs' human and relational capital attributes (years of education, elite education, and work experience, political ties and outside directorships) explain structural power, and that

higher level in some of these attributes can mitigate gender inequality in terms of probability of reaching structural power in Chinese listed firms.

The years and quality of education, work experience, and outside directorships greatly explain CEO's structural power. This echoes Dalziel et al. (2011), that the quality of education contains another perspective of individuals' capability (e.g., superior cognitive ability, legitimacy and valuable social networks) which are hardly to be acquired from extending the length of education. Moreover, our findings concur with Daily and Johnson (1997) and Elliott and Smith (2004), who argued that employees could obtain resources and critical assistance through personal capability and networks, which in turn determine the power they gain within their organizations. Although in our sample period the majority of CEOs were born after 1960, and were less likely to be influenced by the Cultural Revolution, formal education remains a critical attribute for CEOs in Chinese listed firms. Our findings also extend the studies by Xin and Pearce (1996), Fan and Wong (2004), Allen et al. (2005), and You and Du (2012), who underscored the key role of relational capital in the appointment and promotion of top management in China. In addition, we find that although the percentage of female CEOs in China exceeds that of many developed countries (Fan & Wong, 2004; Lam et al., 2013; Ye et al., 2010), there remain barriers that prevents female CEOs from obtaining as much structural power as their male counterparts. Our results also suggest that only multiple directorships show a stronger positive effect on the likelihood of female CEOs obtaining similar or higher structural power than their male counterparts, suggesting that one way for female CEOs to achieve the similar structural power is through investments in relational capital. Overall, our results builds on and extend the perspective that structural power within the organization can be considered as an important reward for the human and relational capital individuals possess (Elliott & Smith, 2004; Powell, 1999; Smith, 2002, 2012).

Contributions

Our study makes a number of significant contributions to the human capital literature, and more specifically to the leadership and gender inequality research. First, we demonstrate the relevance of human capital in explaining individual power within their organizations, and provide evidence that education and experience attributes alone may not suffice to explain CEO structural power in a context where informal systems prevail. More importantly, our results suggest that human and relational capital attributes are complementary, and that when combined, they provide better explanatory power and model fitness to explain CEO structural power, as in the case of Chinese listed firms. This corroborates Powell's (1999) individual-level perspective and Hillman and Dalziel's (2003) integration of human and relational capital perspectives. Our study also departs from leadership studies in the US by investigating CEOs in China, where power is highly concentrated within firms and relational capital is generally far more important than in Western cultures (Allen et al., 2005; Cooke, 2003). Finally, our results have implications for both practitioners and policy makers. We echo the argument by Jiang and Kim (2015) that executives face different job markets and promotion standards in China than their peers in Western countries. Our findings also support the claim that the standards for upward mobility differ between female and male CEOs, and that, at least in the context of Chinese firms, relational

capital can work as a substitute of human capital to overcome gender inequality in the workplace.

Limitations and future research directions

Like all empirical studies, ours has some limitations, which in turn open opportunities for future research. For example, we focus on Chinese firms listed on the Shanghai and Shenzhen A-Share Exchange, and do not consider Chinese firms listed overseas. Second, we do not account for the impact of CEO power on firm-level outcomes. Future research can examine how CEOs' structural power influences firm performance or strategic outcomes. Third, our study only focuses on Chinese firms, which operate under a specific and evolving institutional context. While we believe that our findings are very relevant to other Asian and emerging countries that share similar cultural and societal attributes, as documented by Yukongdi and Benson (2005), future research can extend our research through a larger cross-country analysis of leadership. To conclude, we believe that this study contributes to leadership literature and practice in China, and our findings will generate additional research on corporate governance, and related issues.

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