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Tournament incentives, age diversity and firm performance

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Abstract

This study introduces a new dimension, age diversity of non-CEO executives, which moderates the relationship between promotion-based tournament incentives, measured as the pay gap between the CEO and non-CEO executives, and firm performance. For a sample of Chinese listed firms from 2005 to 2015, we find that the tournament incentives for non-CEO executives relate positively to firm performance. This relationship is weaker when non-CEO executives are from different age cohorts, whereas the tournament effect is enhanced when non-CEO executives are from the same age cohort. The negative moderation effect of age diversity is more pronounced in state firms and in the Northern China Plain cultural region. The negative moderation effect disappears in firms with CEOs who have overseas experience. We reason that the peer pressure among the similar-aged non-CEO executives enhances the tournament competition and that age hierarchy reduces incentives for younger executives to compete. Our findings have important implications for firms not only in China, but also in countries and regions where seniority is highly valued when setting executive compensation and optimizing organizational structure.

JEL codes: G30; J10; J33

Keywords: Executive compensation; Tournament effect; Non-CEO executives; Age diversity; Seniority

1 **Introduction**

The public controversy over the remarkable level of CEO pay continues to flare up in the press. In 2018, the average Chinese CEO earned 127 times more than people earning the national average wage.[1] This excessive pay disparity has also extended to the top echelons of the corporate hierarchy that is between the CEO and other executives at the next level. A large number of academic studies[2] have been devoted to understanding the pay inequality at the workplace and investigate its effect on firm-level outcomes. The tournament theory proposed by Lazear and Rosen (1981) and Rosen (1986) suggests that the pay gap between the CEO and non-CEO executives provides inherent incentives for non-CEO executives to compete with each other. In a rank-order tournament, the executive, who is promoted to the position of CEO, receives the promotion prize measured as the pay gap. This pay gap, combined with the uncertainty about promotion, encourages non-CEO executives to expend more efforts, which, in turn contributes to firm performance.

In this study, we extend the tournament literature by introducing the age heterogeneity of non-CEO executives as a moderator that affects non-CEO executives' incentives to compete. The effectiveness of tournament incentives is found to be stronger when the firm has a sound governance structure, is part of a non-innovative, low-tech industry, operates in countries that value competition, power and fairness in income, and the CEO is an insider or near retirement (e.g., Lee et al., 2008, Kale et al., 2009, Lin et al., 2013, Burns et al., 2017, Shen and Zhang, 2017). Firms need the talent, effort and resources, not only from the CEO, but also from non-CEO executives who occupy important positions in the firm (Pissaris et al.,

[1] See more detailed information at:
https://www.statista.com/statistics/424159/pay-gap-between-ceos-and-average-workers-in-world-by-country/
This excessively high CEO to worker pay ratio not only exists in China, but is also a worldwide issue. For example, in 2018, the average US CEO earned 278 times more than people earning the national average wage.

[2] Various models have emerged to explain executive pay outcomes. See Bebchuk and Fried (2003) and Garen (1994) for the agency model that the optimal contract provides managers with efficient incentives to act in the best interests of shareholders, and Finkelstein (1992) and Lambert et al. (1993) for the managerial power model, which acknowledges the power of executives to shape the compensation decision made by the board.

2017). Under the tournament framework, it is the non-CEO executives who face the promotion-based tournament incentives. To the best of our knowledge, the sociological and psychological profiles of non-CEO executives have been ignored in the previous literature.

Non-CEO executives can be viewed as an appropriate peer group. To compete for the same tournament prize, one executive's effort affects the behaviour of his/her peers, thereby exerting peer pressure on them (Kandel and Lazear, 1992). We argue that non-CEO executives' incentives to compete depend on the age heterogeneity among them. When non-CEO executives are of a similar age, they tend to group themselves into the same social category (Turner, 1985) and believe in a similar chance of a promotion and compete fervently. However, in an age-diverse environment, older managers, with rich experience and influence in the field, often occupy the top positions and have a higher chance of promotion within the company (Mills, 1985, McCampbell et al., 1999, Chen and Chung, 2002, Takahashi, 2006). The presence of an age hierarchy may lead to reduced incentives for younger executives to compete if they anticipate a lower probability of winning the prize. Therefore, we hypothesize that non-CEO executives' incentives to compete become weaker when large age heterogeneity exists but stronger when non-CEO executives are of a similar age.

China provides us with an ideal context to explore whether the age heterogeneity affects non-CEO executives' incentives to compete. Given China's large population and limited resources, competition is fierce especially among similarly aged peers, as they all seek to acquire the same resources (Liu and Lafreniere, 2014). Despite decades of market-based reforms across Mainland China, the Chinese people still hold an underlying set of values based on their Confucian roots (Fan, 2000). According to the Five Codes of Ethics by Confucianism, their values are embedded in a hierarchal and patriarchal system, in which individuals owe respect to their seniors. In a Confucian society, elderly people usually enjoy a higher status and have the most valuable resources (Bond and Hwang, 1986). Empirical

evidence (e.g., Fan, 2000, Wall et al., 2009, Liu, 2012) has documented that Confucianism has played a significant role in shaping the business environment in China. Valuing seniority and age hierarchy could affect the probability of promotion and, therefore, discourage competition in groups.

For a sample of Chinese listed firms from 2005 to 2015, we document a significant and positive relationship between the CEO and non-CEO executives' pay gap and firm performance, which is consistent with the tournament theory. Furthermore, we investigate whether the tournament effect is moderated by the age diversity of non-CEO executives. Our findings suggest that, when non-CEO executives have a higher level of age heterogeneity, the tournament effect becomes weaker. In contrast, the tournament effect is enhanced when non-CEO executives are from the same age cohort. More interestingly, we find that the negative moderation effect of age diversity is more pronounced in state firms than in non-state firms, which indicates a potentially severe age hierarchy problem in the state firms. The negative influence of age diversity on the tournament effect is also more pronounced in the Northern China Plain cultural region, where the Confucianism atmosphere is stronger than in other regions. The negative moderation effect disappears in firms with CEOs who have overseas experience. Our analysis is robust with regard to several alternative measures of tournament incentives, age diversity and firm performance.

To mitigate endogeneity concerns, we employ an identification strategy of propensity score matching and difference-in-difference analysis around the departure of the oldest non-CEO executive to examine the moderating effect of age diversity. Our difference-in-difference results demonstrate that tournament effects become stronger for the years following the departure of the oldest executive and the arrival of a new, younger executive, which confirms our main results. While the results are reassuring, we acknowledge that our experimental design does not fully address all the potential endogeneity biases. For example,

a potential selection bias may emerge as firms do not randomly select the replacement for a departed executive.

This study makes several important contributions to the literature. First, we integrate the tournament model on hierarchical structure of organizational pay (Lazear and Rosen, 1981, Rosen, 1986) with the society hierarchy. The organization theorists have long argued that economic models are too constrained and that non-economic factors that critically affect managerial compensation have been largely ignored (Baron and Cook, 1992). Our study offers a new channel, the age diversity of non-CEO executives capturing the age hierarchy in a society, as a moderator on the pay gap and firm performance relationship.

Second, there is an extensive debate over the efficiency of performance-based promotion and seniority-based promotion at the workplace. Earlier studies focus on the effectiveness of performance-based promotion in motivating executives and improving firm performance mostly in the Western context (e.g., Lee at al., 2008, Kale et al., 2009, Mobbs and Raheja, 2012, Sanchez-Marin and Baixauli-Soler, 2015). However, the seniority-based promotion, traditionally used in Asian countries (i.e., China, Japan and South Korea), has been found to benefit companies in retaining more loyal, competent and experienced employees and reducing conflicts (e.g., Meyer et al., 1993, Fischer and Smith, 2004, Peltokorpi, 2011). In this study, we document the cost of seniority-based promotion system. In countries where seniority is highly valued, the presence of age hierarchy is likely to discourage the younger-generation employees to compete with the senior ones at the workplace, potentially harming firm outputs. Our findings provide new evidence that seniority-based promotion is less efficient than performance-based promotion system in the top management team.

Last, previous literature has studied the impact of management diversity on firm performance, illustrating mixed results. Several studies (e.g., Certo et al., 2006, Dezsö and Ross, 2012, Nielsen and Nielsen, 2013) demonstrate the benefits of diversity, showing that diverse groups are more innovative and have a better ability to solve complex problems,

which boosts decision quality. Only a few studies (e.g., Earley and Mosakowski, 2000, Lovelace et al., 2001, Qian et al., 2013) have highlighted the costs of diversity and argued that too much diversity can create conflicts. Our results provide evidence that "*diversity is itself diverse*" (Klein and Harrison, 2007), supporting the view that the economic impact of diversity is contextually and dimensionally dependent. Although age diversity benefits performance overall, but it weakens tournament incentives. The positive outcomes of management diversity on performance are not warranted for all of the firms.

Our study provides interdisciplinary implications for corporate governance and human resource management. It also highlights the importance of the demographic composition of non-CEO executives in relation to the effectiveness of tournament incentives. The sociological values of executives should be taken into account in setting the internal pay structure. Our results show that, as suggested by Boone and Hendriks (2009), diversity may not always be a positive force: having an age-diverse team may have negative consequences on incentives to compete. The findings from this study are relevant not only for China but also for other countries and regions (e.g., Japan, Korea, Latin America, and Africa), in which seniority is highly valued. Companies should learn to manage the generational gaps in the senior management team and utilize the benefits to obtain the optimal executive composition.

This rest of this paper is organized as follows. In Section 2, we discuss the literature and develop hypotheses on tournament incentives, age diversity and firm performance. Section 3 describes the sample composition and methodology. In Section 4, we discuss our empirical results. Section 5 contains robustness checks. We provide concluding remarks in Section 6.

2 Literature review and hypothesis development

2.1 Tournament incentives and firm performance

The large pay gap between the CEO and non-CEO executives cannot be completely explained by the conventional marginal product argument (O'Reilly et al., 1988). To address this puzzle, Lazear and Rosen (1981) propose the tournament theory, in which tournament participants compete with each other and are paid based on their rank in the competition. Non-CEO executives can be viewed as competing in a tournament. The winner is promoted to the position of CEO and receives the prize equivalent to the pay gap between the CEO and other executives. The possibility of attaining this high status provides irresistible incentives for non-CEO executives to expend more effort and ultimately improves firm performance. However, a large pay gap between the CEO and non-CEO executives increases CEO power (Lambert et al., 1993) and enables entrenched CEOs to increase their ability to set their own pay and expropriate shareholders' wealth (Dye 1984, Kale et al., 2009, Bebchuk et al., 2011). Such pay-gap-created promotion incentives can also lead to greater managerial risk-taking (Kini and Williams, 2012) and a higher propensity to commit fraud (Haß et al., 2015). Since the inputs are difficult to measure, CEO pay gaps can be perceived as unfair, even though CEOs may contribute more (Cowherd and Levine, 1992). As a result, the feeling of deprivation discourages coordination and invites group sabotage at a lower corporate level, which may have a negative impact on firm performance (Lazear, 1989).

The empirical literature provides mixed findings regarding the effect of CEO pay gap on firm performance. A number of studies (e.g, Eriksson, 1999, Lee at al., 2008, Kale et al., 2009, Mobbs and Raheja, 2012, Sanchez-Marin and Baixauli-Soler, 2015) provide evidence that higher pay gaps between the CEO and non-CEO executives are associated with better firm performance, while Conyon et al. (2001) and Bebchuk et al. (2011) show insignificant and opposite results. Several works (e.g., Lin and Lu, 2009, Chen et al., 2011, Kato and Long,

2011, Hu et al., 2013, Lin et al., 2013) find that the tournament theory fits well in China[3]. In our study, we extend the tournament framework by introducing the age heterogeneity of non-CEO executives as a moderator that affects non-CEO executives' incentives to compete.

2.2 Peer effect, age and seniority

Under the tournament framework, the CEO pay gap provides non-CEO executives with incentives to expend more efforts, which, in turn increases their chances of promotion and contributes to firm performance. Non-CEO executives can be viewed as an appropriate peer group at the top level of the firm. To compete for the same tournament prize, the promotion to the CEO position, one non-CEO executive's effort can affect the behaviour of his/her peers and exert peer pressure on them. Modern corporations are usually managed by a group of executives who work as a team. At the group level, age is a salient variable of social categorization. Same-aged individuals attract each other and usually group together (Lawrence, 1988). According to the social categorization theory (Turner, 1985) and the similarity-attraction paradigm (Byrne, 1971), individuals of a similar age are more likely to develop similar values. A higher demographic similarity leads to a greater perception of fairness among them (Tajfel, 1970). Under the tournament promotion system, non-CEO executives of a similar age might consider themselves to be in the same social category with similar experience, thereby having a similar probability of winning the tournament prize. Thus, non-CEO executives of a similar age have more incentives to compete.

Age conveys information about an individual's cumulative human capital, such as education, experience and intellectual ability (Child, 1974, Medawar, 1952, Rhodes, 1983). Career opportunities might be heavily age-biased at workplaces with heterogeneous age composition (Kunze et al., 2013). In many cases, the supervisors and employees at higher ranks of the corporate ladder are older than those at lower levels. The presence of age

[3] Different from pervious studies in China, we employ the compensation data for each individual executive.

hierarchy might produce the feeling of "collective relative deprivation" among groups (Snape and Redman, 2003).

In countries influenced by Confucianism, seniority is highly valued, and the elderly are traditionally considered to be the locus of wisdom, authority and power. In the Chinese society, there is an ethical morality of respect for seniority, which is the product of Confucianism dating back to antiquity. Senior people enjoy power not only in the household but also in politics and organizations (Chen and Chung, 2002). They are generally believed to possess a richer experience, vaster knowledge and greater influence/reputation in a specific field, when compared to younger people (Mishra and Jhunjhunwala, 2013). The phenomenon of age hierarchy/discrimination and "collective relative deprivation" is more severe in the Chinese context. As a result, younger employees might have the impression that they are disadvantaged due to their young age, while other senior or older groups are favoured (Kunze et al., 2013). The feeling of relative deprivation reduces non-CEO executives' incentives to compete.

2.3 Age heterogeneity and tournament incentives

On the basis of social categorization theory (Turner, 1985) and the similarity-attraction paradigm (Byrne, 1971), age similarity among non-CEO executives leads to greater perception of fairness and higher group integration. Therefore, under the tournament promotion system, non-CEO executives of similar ages have more incentives to compete. We expect the peer competition among non-CEO executives of a similar age to enhance the tournament effect. In relation to age hierarchy/discrimination and seniority arguments, ceteris paribus, we would expect elderly non-CEO executives to be more likely to be promoted at Chinese firms, while younger executives have a relatively lower chance for a promotion unless they have an outstanding talent and competence. As such, seniority reduces incentives for young non-CEO executives to compete and increases their inclination to devote less effort

at work, which ultimately weakens the tournament effect. Therefore, we expect a negative moderating effect of age heterogeneity and propose the following hypothesis:

H_1: The tournament effect is weaker (stronger) in firms where the non-CEO executives have a higher (lower) level of age heterogeneity.

In recent years, the Chinese Communist Party has placed significant emphasis on the important role of Confucianism in the new age of reform and made seniority one of the most discernible factors when nominating government candidates in China (Chen and Chung, 2002). Anecdotal evidence shows that elderly leaders play an important role in Chinese politics. For example, the average age of the top seven leaders in the Chinese Politburo's Standing Committee is 65.86 years, and their ages range from 63 to 70.[4] This phenomenon of seniority has extended from politics to the workplace, especially state firms, where executives are promoted within the Chinese Communist Party and the government. Recently, the Chinese press (People.cn, Oct 2016) has suggested that state firms should eradicate the idea of seniority as a basis for promotion. Therefore, we hypothesize the following：

H_2. The negative moderating effect of age diversity on tournament incentives is more pronounced in state firms than non-state firms.

Countries differ from one another with respect to culture, legal environment and economic development (Hofstede, 1980). Studying or working in a foreign country provides CEOs with a unique experience that cannot be acquired in their home country (Roth, 1995). With the increased emphasis on globalization, the percentage of CEOs with overseas experience in our sample firms increases from 3.6% in 2005 to 7.3% in 2015[5]. CEOs with overseas experience are more likely to be influenced by the foreign country's culture. In turn, they bring Westernized business ideas and values back to the firm, and the traditional culture

[4] See more detailed information at: https://www.bbc.com/zhongwen/simp/chinese-news-41745184

[5] In our sample, most of CEOs (with three exceptions only) have overseas experience from developed countries, including the US, the UK, Canada, Australia, New Zealand, Switzerland, Italy, Japan, France, Germany, Singapore, Spain, Belgium, Sweden, and the Netherlands.

of Confucianism and placing a high value on seniority might be weakened. We therefore propose the following:

H_3. The negative moderating effect of age diversity on the tournament incentive is less severe in firm with CEOs who have overseas experience.

Confucianism is one of the most influential philosophies in China and has shaped the Chinese society (Hu, 2007). Given its large population and huge land area, China can be divided into ten geographical cultural regions. In China, Confucianism originated from the Shandong Province, from which it spreads to other areas. In particular, the region of North China Plain (Shandong Province, Hebei Province, Henan Province, north of Anhui Province, north of Jiangsu Province, Beijing and Tianjin) is most influenced by the philosophy of Confucianism and seniority value and thus firms located in this region are more likely to be influenced. Therefore, we hypothesize the following:

H_4. The negative moderating effect of age diversity on the tournament incentives is more pronounced in firms located in the North China Plain cultural region than the other regions.

3 Sample selection and research design

3.1 Sample and data

Our initial sample includes all firms listed on the Shanghai or Shenzhen Stock Exchanges from the CSMAR database for the period of 2005-2015. Our sample period starts in 2005, as it is the first year for which individual executive compensation is available[6]. The CSMAR database reports 1,342 listed firms on the Shanghai and Shenzhen Stock Exchanges in 2005, which increased to 2,690 by 2015. Following the previous studies (e.g., Chen et al., 2011, Hu et al., 2013, Lin et al., 2013), we first exclude financial firms due to their unique accounting characteristics. We define the CEO as the person who is identified as the chief

[6] In 2001, the China Securities Regulation Committee (CSRC) promulgated *the Rules No. 2 on Contents and Format of Information Disclosure by Companies Offering Securities* according to which listed firms are required to disclose the remuneration for individual executives, directors and supervisors. Most companies complied from 2002 by disclosing the aggregated compensation of the top three executives only.

executive officer or general manager. All other executives are classified as non-CEO executives. Following Kale et al. (2009), we include only companies that have an identifiable CEO and at least three non-CEO executives with disclosed remuneration and demographic information (i.e., age). We further exclude companies that have less than two firm-year observations. After the data filtering procedure, our final sample consists of 15,448 firm–year observations. All explanatory variables are lagged by one year to mitigate endogeneity problem.

3.2 Model specifications

The baseline tournament framework is modelled in the following Equation (1):

$$Firm\ Performance_{it} = \alpha + \beta Pay\ Gap_{it-1} + X_{it-1}\delta + \theta_t + \mu_i + \varepsilon_{it}, \quad (1)$$

where i is the firm identifier, and t is the year. β captures the influence of pay gap between the CEO and other executives ($Pay\ Gap$) on firm performance. Year and firm fixed effects are denoted by θ and μ, respectively. ε is the error term, while X is the vector of control variables as discussed below. Equations (1) is estimated by a fixed-effects (FE) estimator with robust standard errors. All right-hand side variables are lagged to reduce simultaneity concerns.

We hypothesize (H_1) that age diversity of non-CEO executives can moderate the relationship between CEO pay gap and firm performance. To test this hypothesis, we build upon the tournament model in Equation (1) and include the age diversity of non-CEO executives and its interaction term with the pay gap in the following Equation (2):

$$Firm\ Performance_{it} = \alpha + \beta Pay\ Gap_{it-1} + \gamma Age\ Diversity_{it-1} + \varphi Pay\ Gap_{it-1} * Age\ Diversity_{it-1} + X_{it-1}\delta + \theta_t + \mu_i + \varepsilon_{it} \quad (2)$$

The coefficient of the interaction variable (*Pay Gap *Age Diversity*) φ in Equation (2) captures the moderation effect of the age diversity of non-CEO executives.

3.3 Description of variables

3.3.1 Pay gap

Following Eriksson (1999) and Kale et al. (2009), our primary tournament measure is the compensation gap between the CEO and non-CEO executives, which captures the strength of tournament incentives, as it reflects the increase in compensation if an executive wins the tournament. In the US, equity-based incentives (i.e., stock options and restricted stock) account for a substantial proportion of executive compensation package (Bryson et al., 2014, Conyon and He, 2016). For example, more than 93% of US firms offer stock options and restricted stock to CEO during our sample period (2005-2015). On average, stock-based compensation comprises around 42.68% of total CEO pay. However, the incentives offered to executives in Chinese firms differ from those in the US. Equity-based compensation in the forms of stock options granted to executives was only permitted from 2006 and is very rare in Chinese firms (Bryson et al., 2014, Cheng et al., 2015, Conyon and He, 2016, Bae et al., 2019). During our sample period (2005-2015), on average, less than 10% of firms granted stock options or restricted stocks to executives each year. Particularly, only 1.07% of firms granted stock options or restricted stocks to executives in 2006, while the number in 2015 increased to 9.26% (See Appendix B). Therefore, non-cash compensation constitutes a very small percentage of executives' total compensation in Chinese firms. In our study, we follow previous studies (Bryson et al., 2014, Cheng et al., 2015, Conyon and He, 2016, Bae et al., 2019) to use total cash remuneration (i.e., salary and bonus). Then we apply the logarithmic transformation of the pay gap as follows:

Log($Pay\ Gap$)= Log (Compensation of CEO – Median value of compensation of non-CEO executives)[7]

[7] In some cases, the CEO is not the highest paid executive in the firm, and the CEO's remuneration is less than the median compensation of non-CEO executives, which results in a negative pay gap. To address this issue, we follow previous studies (e.g., Hartman, 1984, Kale et al., 2009) and add the absolute value of the minimum negative pay gap to each observation, to transform all the observations monotonically.

3.3.2 Age diversity of non-CEO executives

We employ a new measure, age cohorts, to capture the age diversity among non-CEO executives. Previous studies suggest that age-induced differences between individuals are most evident across different generations (Pilcher, 1994) and that each generation comes into existence with a particular social movement and a shared experience (Sun and Wang, 2010). Since most of an individual's values become entrenched in her late teens (Ralston et al., 1999), we define four age cohorts that correspond to historical social and political events in China at the age of 18. These four cohorts are based on an executive's birth year: 1931–1947 cohort (Communist Consolidation generation), 1948–1958 cohort (Cultural Revolution generation), 1959–1974 cohort (Social Reform generation) and 1975–1992 cohort (Societal generation) (Ralston et al., 1999, Egri and Ralston, 2004).

To measure the age diversity, we calculate the number of cohorts among non-CEO executives (*Number of Cohorts*). The larger the number of cohorts, the higher the age diversity level is. We also construct two dummy variables. *2 Cohorts* equals one if the non-CEO executives are from any two different age cohorts, and zero otherwise. *3+ Cohorts* equals one if the non-CEO executives are from any three or more different age cohorts, and zero otherwise.

3.3.3 Firm performance and control variables

We employ two firm performance measures.[8] Return on Assets (*ROA*) is the ratio of the firm's net income to total assets. Return on Equity (*ROE*) is defined as the firm's net income divided by book value of total equity. We group the control variables into four categories. First, the three variables on board characteristics include the natural logarithm of board size (*Board size*), the percentage of independent directors (*Independent directors*), and a dummy variable (*Duality*), which equals one if the CEO is also the chairman. Second, we

[8] Market-based performance measures (i.e., stock return and Tobin's Q) are widely used in developed countries but are not appropriate for China due to the non-tradable shares and market being highly speculative.

control for other CEO characteristics including the percentage of female executives (*Female executives*), the natural logarithm of CEO age (*CEO age*), and the average age of non-CEO executives (*Executives age*). Third, we employ the ownership control variables including the proportions of shares owned by state-owned enterprises/central/local governments (*State*) and foreign investors (*Foreign*). Finally, some firm-specific characteristics, such as size, leverage and firm age, are also controlled for. All variable definitions are summarized in Appendix A.

3.4 Descriptive statistics

Table 1 presents summary statistics for our sample. Similar to previous studies on China (e.g., Lin and Lu, 2009, Chen et al., 2011, Hu et al., 2013), *ROA* and *ROE* reported in Panel A are on average 0.05 and 0.07, respectively. Panel B reports the measures for tournament incentives. The average pay gap between the CEO and non-CEO executives is 204.36 thousand CNY (32.81 thousand USD). The pay gap has a large spread with 15,722.5 thousand CNY (2,472.01 thousand USD) as the maximum value. The average pay gap at Chinese listed firms has an upward trend increasing from 78.95 thousand CNY (12.41 thousand USD) in 2005 to 272.98 thousand CNY (42.92 thousand USD) in 2015 (nearly quadrupled).

<Insert Table 1 about here>

Panel C presents the age characteristics of non-CEO executives. After dividing all non-CEO executives into four age cohorts, we find that, in more than half of the sample firms, non-CEO executives are from two different age cohorts. Figure 1 shows that one age cohort composition remains stable at approximately 20% of the firms and that three or more age cohorts fluctuate between 20% and 30% from 2005 to 2015.

<Insert Figure 1 about here>

Panel D reports summary statistics for the control variables. On average, board size is 8.99 in our sample firms, with 37% independent directors. These figures are close to the 9.11

and 33.2% reported for Chinese firms by Hu et al. (2013) and satisfy the requirement of CSRC that more than one third of the board should be comprised of independent directors. Female executives account for 15% of the total number of executives, and 20% of CEOs hold a dual position of chairman. The CEOs are on average 48.22 years old with the oldest age being 78, while non-CEO executives have an average age of 46.49. With regard to ownership structure, shares held by the state-owned enterprise or government averages at 10%. The leverage is around 0.46, which is comparable with that shown as 0.46 and 0.47 for Chinese firms in Hu et al. (2013) and Liu et al. (2014), respectively. In addition, the firms' average listed age is around 9.69 years.

We also compare the performance across firms with different age diversities conditional on the pay gap between CEO and other senior executives (small/medium/large) in Appendix C. We observe significant differences in ROA and ROE cross these three groups. Firm with large pay gap are associated with higher ROA and ROE. As shown in Figure 2, the coefficient on age diversity shows a downward trend in general and becomes negative when CEO pay gap exceeds the break point. Consistently, in Appendix C, when the CEO pay gap is small, firm performance increases with the number of age cohorts among non-CEO executives. However, as the tournament incentives (i.e., CEO pay gap) becomes larger, firms with non-CEO executives from three or more age cohorts perform worse. We conclude that when the pay gap is large, a higher level of age diversity among non-CEO executives can harm the overall firm performance.

A correlation matrix of main variables used in Equations (1) and (2) is presented in Appendix D. Previous studies suggest that a correlation of 0.7 or higher in absolute value indicates a multicollinearity (e.g., Liu et al., 2014). Appendix D shows that only two performance measures (*ROA* and *ROE*) are highly correlated. With respect to other variables,

there is no clear evidence of multicollinearity. The test for multicollinearity is also conducted, and the magnitude of VIF is generally small.

4 Empirical analysis

4.1 Tournament incentives and firm performance

Table 2 reports the result of Equation (1) using fixed effects models. Our results confirm that the tournament theory is supported in the Chinese context (e.g., Kale et al., 2009, Chen et al., 2011, Hu et al., 2013) that the tournament prize is positively and significantly associated with firm performance. With respect to the control variables, similar to Kato and Long (2011) and Liu et al. (2014), we find that state ownership has a significant and positive impact on firm performance, as firms' political connections may help them to receive more support and preferential treatment from the government and gain better access to resources, authorities and business connections (Sun et al., 2002, Tian and Estrin, 2008, Yu, 2013). We also find that the degree of leverage is positively related to firm performance and that firms with a larger size show worse levels of *ROA* and *ROE*. In addition, firm age exerts a significant and negative influence on *ROA* at the 5% level, which is in line with Liu et al. (2014).

<Insert Table 2 about here>

4.2 Age heterogeneity and tournament incentives

Next, we test our hypothesis (H_1) of whether the age heterogeneity among non-CEO executives negatively moderates the relationship between the CEO pay gap and firm performance. Columns (1) and (2) of Table 3 report the regressions results based on estimating Equation (2) on firm performance with the interaction of pay gap with age heterogeneity.

<Insert Table 3 about here>

Consistent with Table 2, the positive relationship between the CEO pay gap and firm performance still holds. Irrespective of firm performance measures, the coefficient on the interaction term between *Log (Pay gap)* and *Number of cohorts* is negative and significant at the 1% level. This provides strong support for our hypothesis (H_1) that tournament incentives are likely to be weaker in firms where non-CEO executives have more heterogeneous ages.

To further test whether the negative moderating effect is linear across different age cohorts, in columns (3) and (4) of Table 3, we construct two dummy variables for the cohort number (*2 Cohorts* and *3+ Cohorts*) to measure age diversity in Equation (2). Again, the estimated coefficients of the interactions for *2Cohorts* and *3+Cohorts* are negative and significant. The magnitude of the coefficients for *3+Cohort*s is larger than that for *2Cohorts* for both *ROA* and *ROE* specifications. This result confirms that the tournament effect becomes weaker when the number of age cohorts among non-CEO executives increases and that the negative effect is more significant when there are three or more age cohorts among non-CEO executives.

Although our regression estimates suggest a positive main effect of age diversity on firm performance,[9] we further explore the marginal effect of age diversity on firm performance. Figure 2 visualises that the coefficient of *Number of cohorts* on firm performance shows a downward trend in general and becomes negative when *Log (Pay gap)* exceeds the breakeven point (value of 8).[10] For example, if the *Log (Pay gap)* equals to 8.5 (i.e., a pay gap of 2,194 thousand CNY), one unit change in the number of cohorts (e.g., two to three) leads to an approximately 1.8 percentage point decrease in ROA and a 4.7 percentage point drop in ROE. In other words, when tournament incentives measured as the

[9] This is consistent with the view of Certo et al. (2006), Dezsö and Ross (2012) and Nielsen and Nielsen (2013) that executives at different ages bring multiple and complementary resources (e.g., ideas, knowledge, and skills) to the team, which boosts the information quality and creative synthesis.

[10] In our sample, approximately 20% of the firms' *Log (Pay gap)* is greater than 8 (260 thousand CNY).

pay gap are large, the age diversity of non-CEO executives can indeed harm firm performance.

<Insert Figure 2 about here>

4.3 Additional tests on seniority

In this section, we perform additional tests on the seniority argument that young executives are discouraged from competing with older executives and thus make less of an effort. In a scenario in which there is only one old non-CEO executive, he/she is more likely to be the heir to the CEO. In Model (2), we introduce a dummy variable (*One old*) capturing this one and only non-CEO executive in the oldest age group within the firm. Columns (1) and (2) of Table 4 show that the coefficients on the interaction term are negative and significant, which support our seniority argument.

Next, we argue that the distance of age cohorts can also matter to tournament incentives. In an environment with age hierarchy, the probability of promotion for executives in the 1931-1947 cohort (oldest) might not be that different from the 1948-1958 cohort, but it can be very different from the 1975-1992 cohort (youngest). Thus, we construct two cohort-distance indicators: *Distance*2 is equal to one, if the executives are from the 1931-1947 and the 1959-1974 cohorts, or from the 1948-1958 and the 1975-1992 cohorts, and *Distance*3 is equal to one, if the executives are from the 1931-1947 and the 1975-1992 cohorts.[11] Columns (3) and (4) of Table 4 show that the tournament effect becomes weaker when the cohort distance increases, with the interaction of *Distance3* picking up the most negative coefficient. Compared to neighbouring cohorts (the reference group), younger executives from the youngest (1975-1992) cohort are more likely to be discouraged from competing with the oldest (1931-1947) cohort, which weakens the tournament effect.

<Insert Table 4 about here>

[11] When the executives are from two neighbouring cohorts (i.e., 1931-1947 and 1948-1958 cohorts, 1948-1958 and 1959-1974 cohorts, or 1959-1974 and 1975-1992 cohorts), the distance is equal to one (reference group).

Overall, our results provide evidence for the seniority argument in Chinese society (Chen and Chung, 2002, Mishra and Jhunjhunwala, 2013). Influenced by Confucian culture, if young non-CEO executives perceive a lower chance of winning the tournament prize, they may be discouraged from competing with the older non-CEO executives and may spend less effort in their work, which consequently leads to a weaker tournament effect.

4.4 Does the impact of age diversity on the tournament effect vary by ownership?

To test Hypothesis (H_2) whether the moderating effect of age diversity on tournament incentives varies by ownership, we divide the sample into state and non-state firms. The univariate test results in Panel A of Table 5 show that, on average, state firms have a significantly smaller CEO pay gap, a lower age heterogeneity among non-CEO executives, and an older CEO than non-state firms. Panel B of Table 5 shows that, in models (3) to (4) for state firms, the coefficient on interaction term between the pay gap and the number of age cohorts is negative and significant at the 5% level in the *ROA* specification (-0.031) and significant at the 10% level in the *ROE* specification (-0.060). In models (1) to (2) for non-state firms, the coefficient on the interaction term is significant and negative only when the firm performance is measured by *ROA,* and the magnitude of the coefficient (-0.013) is smaller than the -0.031 for state firms. We also perform tests for the equality of means of interaction terms across the state and non-state samples. The differences are significant at the 1% level. The results support H_2 that the negative influence of age heterogeneity on the tournament effect is more significant in state firms than non-state firms due to the outmoded practice of seniority that is overstressed at the government and state firms.

<Insert Table 5 about here>

4.5 Does the impact of age diversity on the tournament effect vary by the CEO's overseas experience?

To test Hypothesis (H_3) whether the moderating effect of age diversity on tournament incentives varies by the CEO's overseas experience, we divide the sample into two sub-

groups: firms with CEOs who have overseas work experience, overseas study experience, overseas permanent residence rights or foreign nationality, and firms with CEOs who have no overseas experience. The univariate test results in Panel A of Table 5 demonstrate significant differences in the CEO pay gap and CEO age between the two sub-groups. On average, CEOs with overseas experience are significantly younger than those without overseas experience, while the CEO pay gap is significantly larger in firms with CEOs who have overseas experience. For the regression results reported in Panel B of Table 5, we find that the coefficient on the interaction term between the pay gap and number of age cohorts is negative and significant in models (7) and (8) for firms with CEOs who have no overseas experience, while insignificant coefficient is observed on the interactions term in models (5) and (6) for firms with CEOs who have overseas experience. The findings confirm our Hypothesis (H_3) that the negative effect of age diversity on the tournament effect is less severe in firms where CEOs have overseas experience, as those firms are more Westernized and less influenced by Confucianism.

4.6 Does the impact of age diversity on the tournament effect vary by cultural regions?

To test Hypothesis (H_4) whether the moderating effect of age diversity on tournament incentives varies by geographic regions, we divide our sample into firms located in Confucian-oriented region (North China Plain region) and other regions. In Panel A of Table 5, we find that, on average, firms located in the North China Plain region have a significantly lower pay gap between the CEO and non-CEO executives. Panel B of Table 5 report the regression results for the North China Plain cultural region in models (11) to (12) and other regions in models (9) to (10). We find that the coefficient on interaction term between the pay gap and number of age cohorts is significant and negative for firms located in the North China Plain cultural region at the 1% level in all specifications. For firms located in other regions, the negative interaction term is significant at the 5% level when firm performance is

measured by *ROA* and *ROE*. The magnitude of coefficient in models (11) and (12) is larger than models (9) and (10). We also perform tests for the equality of means of interaction terms across firms located in the North China Plain cultural region and firms located in the other regions. The results are significant at the 1% level. The economic and statistical significance of the coefficient together support H_4 that the negative impact of age diversity among non-CEO executives is more pronounced in the North China Plain cultural region than the other regions.

5 Robustness checks

5.1 Difference-in-difference matching approach

In this section, we address the endogeneity concerns in our main models. In Equations (1) and (2), the relationship between CEO pay gap and firm performance may be biased due to reverse causality. For example, the CEO pay gap might act as a tournament incentive to motivate non-executives and consequently improve firm performance. Alternatively, firms that perform better may compensate their CEOs more than other subordinates, widening the pay gap. In addition, one may raise a concern on the endogeneity between the age diversity and firm performance, as poor performance may induce changes to the senior management team. The firm can replace the incumbent executive with an older executive who are more experienced. As a result, the age diversity of non-CEO executives will change. Further, the relation between pay gap and age diversity may be another concern, as age diversity could directly affect CEO pay gap. In the baseline model, we employed the firm fixed-effects estimator with one-year lagged independent variables, which controls for the unobserved heterogeneity and also partially alleviates the reverse causality.

To further address the concern that age diversity could directly affect pay gap, we have used an exogenous shock to age diversity and re-estimate our baseline model. Specifically, we have employed the propensity score matching (PSM) method and the

difference-in-difference (DiD) analysis around the departure of the oldest non-CEO executive to identify the moderating effects of age diversity on the relationship between pay gap and firm performance. The treatment group comprises firms where the oldest non-CEO executive departures and an executive from a younger cohort with similar cash compensation joins in.[12] For the control group, we include firms when the oldest non-CEO executive leaves, but an executive from the same or older age cohort joins the firm. The application of our selection criteria results in 261 cases for our treatment group and 465 cases for the control group.

We then use the PSM method to match each treatment observation with a control one in order to obtain better casual treatment effects. This matching approach rules out the possibility that our DiD estimation is driven by the difference in executive- or firm-characteristics. We first estimate the probability that a firm replaces the oldest non-CEO executive with an executive who is from a younger cohort with similar cash compensation. The probability is obtained from a logit regression using the same controls as those included in the main Equation (2). Next, we apply the one-to-one nearest neighbour matching algorithm to identify a group of matched treatment and control observations.[13] Finally, we obtain 149 pairs of matched firms. To check the matching balance, we also conduct a diagnostic test where we estimate the post-matching difference in firm characteristics between treatment and control observations in Table 6. The comparison indicates no significant differences across these two groups.

<Insert Table 6 about here>

Based on the matched sample, we estimate the following DID regression:

[12] In our sample, it is very difficult to obtain exactly the same pay gap after the executive transition, because the cash compensation includes both salary and bonus. Therefore, we restrict CEO pay gap change followed by the oldest executive turnover to be less than 1%.

[13] We further require that the propensity score difference between the treatment observation and its matched peer should not exceed 0.01 in absolute value.

$$Firm\ Performance_{it} = \alpha + \beta_1 Pay\ Gap_{it} + \beta_2 Pay\ Gap_{it} * Treat_i + \beta_3 Pay\ Gap_{it} * Post_{i,t} + \beta_4 Pay\ Gap_{it} * Post_{it} * Treat_i + \beta_5\ Post_{i,t} * Treat_i + + X_{it}\delta + \theta_t + \mu_i + \varepsilon_{it} \quad (3)$$

where *Treat* is an indicator variable that equals to one for firms in the treatment group. *Post* is a dummy variable that equals one if the year is after the oldest non-CEO executive is replaced with a new executive, and zero otherwise.[14] X_{it} is the same set of control variables used in Equation (2).

Columns (1) and (2) of Table 7 present the DiD regression results one year before and one year after the treatment. The coefficient on *Log (Pay gap) *Post*Treat* is significant and positive at 5% level, indicating that treatment firms have stronger tournament effects for the years following the departure of the oldest executive and the arrival of a new executive from a younger age cohort. Alternatively, we also conduct the DiD regression two years before and after the treatment and obtain similar results in Columns (3) and (4). This finding confirms our main hypothesis. Replacing an older executive by a younger executive reduces age diversity among non-CEO executive, thereby seniority is less likely to be an issue. With a perceived similar chance for promotion, the peer competition among these executives enhances the tournament effects. While our difference-in-difference analysis supports baseline results, we recognise that a potential selection bias arising from the replacement of a departed executive may not be fully addressed.

<Insert Table 7 about here>

5.2 Performance persistence

Performance persistence is often a focus of corporate governance research (e.g., Goergen et al., 2015, Sila et al., 2016). The previous realization of the dependent variable might affect the current level of some independent variables. In our study, current CEO pay

[14] Our analysis includes firm-year observations one (two) year before and one (two) year after the oldest non-CEO executive is replaced with a new executive, excluding the year of the replacement.

gap and current age diversity of non-CEO executives may be the result of past firm performance. It may be the case that firms with better past performance reward the CEO with higher remuneration, widening the pay gap at the top level. Firms with worse past performance may replace the incumbent executive with an older executive, increasing the level of age diversity among non-CEO executives. To address these issues, we follow Wintoki et al. (2012) to employ the Dynamic Panel Data Generalized Method of Moments (GMM) estimator (Arellano and Bond, 1991), which accounts for unobserved heterogeneity as well as dynamic relation in our model. GMM regression results are reported in Table 8. All the independent variables are assumed to be endogenous except for the year dummies. The instruments used in the GMM estimation include the lagged differences (t-2) of endogenous variables and dependent variable for the level equation, and the lagged levels (t-3 to t-4) of the endogenous variables and dependent variable for the difference equation. Consistent with our main results, Table 8 reports significant positive effects of pay gap on firm performance. We also find that the coefficient of interaction term is negative and significant in both *ROA* and *ROE* specifications. Therefore, our previous results are not driven by the dynamic endogeneity problem.

<Insert Table 8 about here>

5.3 Firm risk

Previous literature has suggested that tournament incentives can not only improve firm performance (Kale et al., 2010), but also result in greater risk-taking (Kini and Williams, 2012, Coles et al., 2018). Competing in a tournament for the position of CEO, non-CEO executives are encouraged to pursue risks in the hope of increasing their promotion prospects, as risky projects are likely to make extreme payoffs (Goel and Thakor, 2008). Moreover, the risk preference of non-CEO executives will be stronger when the tournament prize is larger (Coles et al., 2018). To estimate whether firm risk also varies as a result of seniority in the

tournament competition, we repeat our main tests after replacing firm performance with firm risk. Specifically, we investigate the moderating effects of age diversity among non-CEO executives on the relationship between pay gap and firm risk using Equation (4).

$$Firm\ Risk_{it} = \alpha + \beta Pay\ Gap_{it-1} + \gamma Age\ Diversity_{it-1} + \varphi Pay\ Gap_{it-1} * Age\ Diversity_{it-1} + X_{it-1}\delta + \theta_t + \mu_i + \varepsilon_{it} \quad (4)$$

We employ daily stock return volatility, defined as standard deviation of daily stock returns for a given year, to proxy firm risk (Bernile et al., 2018, Coles et al., 2018). Based on prior literature (e.g., Kini and Williams, 2012, Bernile et al., 2018, Coles et al., 2018), we also control for Duality, Female Executives, CEO age, State, Foreign, Executives age, ROA, Leverage, Tobins' Q, Firm age and Firm size. In Table 9, we document a positive effect of CEO pay gap on stock return volatility, which is consistent with previous studies (Kini and Williams, 2012, Coles et al., 2018). We show evidence that the tournament incentives provide a strong motivation for the non-CEO executives to take more risks for the sake of better performance. Specifically, the coefficient on the interaction term between *Log* (*Pay gap)* and *Number of cohorts* is negative and significant at the 5% level, implying that tournament effect weakens in firms when the other executives come from different generations. While seniority discourages younger executives to compete with the older generation, younger executives are more likely to play safe which leads to a lower level of firm risk. Our results show a robust tournament effect that both firm performance and risk vary as a result of seniority in Chinese firms.

<Insert Table 9 about here>

We have also conducted sub-group analysis based on state ownership, CEO overseas experience and geographic effects. Similar to firm performance, in Table 10, we observe that

the negative moderating effect of age diversity on the relationship between pay gap and firm risk concentrates in state firms and in firms where CEOs have no overseas experience. However, the tournament incentives have no significant effects on firm risk in North Plain Region where the Confucianism originated. This might be explained by the "conservatism" elements of Confucianism, which has been heavily addressed in firms located in the North Plain Region. Therefore, executives in these firms are less likely to pursue aggressive risk-taking.

<Insert Table 10 about here>

5.4 Age diversity and pay gap

One may argue that the age diversity of non-CEO executives (*Number of Cohorts*), might have an impact on *Pay Gap,* and thus indirectly affect firm performance through *Pay Gap*. To address this concern, we regress *Pay Gap* on *Number of Cohorts* and use the residuals that are unrelated with age diversity in Equation (2) without the interaction term and *Number of Cohorts*. In line with our previous results, we still find that *Log (Pay Gap)* is positively and significantly related with all firm performance measures in Table 11. Our finding rules out the possibility that age diversity has significant influence on pay gap.

<Insert Table 11 about here>

5.5 Alternative explanations and additional robustness

5.5.1 Family ownership

The organizational structure of family firms can be different from other firms due to "familism". The controlling family may use narrow kinship networks in making hiring and promotion decisions (Bertrand and Schoar, 2006). Thus, the tournament competition and seniority may matter less in family firms. Here, we repeat our analysis in family and non-family firms. In Panel A of Table 12, family firms, on average, have significantly younger CEOs, lower pay gaps, and a higher level of age diversity among non-CEO executives. Consistent with our argument, in Panel B of Table 12, the coefficients of tournament

incentives and the interaction term are not significant in family firms across all the specifications, while negative and significant coefficients of interaction term are found in non-family firms.[15] This result suggests that the negative impact of age diversity on tournament effect only matters in non-family firms.

<Insert Table 12 about here>

5.5.2 Alternative measures of tournament incentive and age diversity

We also conduct further analysis using alternative measures of tournament incentives and age diversity. Following Goergen et al. (2015), we replace the cohort composition measures with the age dissimilarity measure (*Age dissimilarity (>20)*) in models (1) to (2) in Panel A of Table 13. In models (3) to (4) of Panel A, we employ the coefficient of variance (*CV*) of non-CEO executives' age as the age diversity measure. Similar to previous results, we find that the coefficient on interaction term is negative and statistically significant in all the specifications. The results confirm that non-CEO executives with mixed ages weaken the positive relationship between the pay gap between executives and firm performance, which is consistent with our hypothesis (H_1).

<Insert Table 13 about here>

Given the fact that the CEO is not the highest paid executive in some cases, following Chen et al. (2011), we employ the compensation difference between the highest paid executive and second highest paid executive (*Log* $(Pay\ Gap_1)$) to measure tournament incentives. We also use the compensation gap between the CEO and the mean value of other executives (*Log* $(Pay\ Gap_2)$) and the fraction of CEO pay to the mean value of other executives *(Pay slice)* as alternative measures. In Panel B of Table 13, we note that *Log* $(Pay\ Gap_1)$, *Log* $(Pay\ Gap_2)$ and *Pay slice* are positively and significantly associated with firm performance. In addition, the coefficient on interaction term is negative and significant

[15] We also perform tests for the equality of means of interaction terms across the family and non-family samples. The differences are significant at the 1% level.

in all the specifications (except column (6)). These results are similar to our previous findings and support our hypothesis that the pay gap acts as a tournament incentive to motivate executives and increases firm performance and that age diversity among non-CEO executives weakens the tournament effect in Chinese firms.

6 Conclusion

Using a comprehensive dataset of Chinese listed firms from 2005 to 2015, we find that the tournament incentives, measured as the pay difference between the CEO and the median value of non-CEO executives, is associated with better firm performance. Our empirical findings show that the tournament effects are negatively moderated by age diversity of non-CEO executives. In other words, the positive relationship between the pay gap and firm performance becomes stronger when the non-CEO executives are from the same age cohort, but the tournament effect is weaker for firms in which the non-CEO executives come from different age cohorts. We propose a seniority argument. In the Chinese society influenced by Confucianism, senior people are highly valued, because they are regarded as the locus of knowledge, power and authority. The presence of seniority reduces the incentives for younger executives to compete with older executives. Overall, our study highlights the important role that non-CEO executives' incentives play in determining the impact of tournament effects.

Our sub-sample analysis reveals that the negative moderation effect of age diversity on tournaments is more severe in state firms than in non-state firms, indicating that the importance of seniority for promotion is overemphasized in state firms. In addition, the negative influence of age diversity on the tournament effect is more pronounced in the North China Plain cultural region, where the Confucianism atmosphere is strong. The negative effect of age diversity on tournament effect disappears in firms with CEOs who have overseas experience, as those firms are more Westernized and less influenced by

Confucianism. These findings provide useful guidance for Chinese policymakers, regulators and corporate decision makers concerning executive compensation. The rank order tournament is an important incentive mechanism to motivate employees in Chinese firms. Our study provides interdisciplinary evidence that the age composition among non-CEO executives is important and that firms should consider adding executives with similar ages to their top management team in order to lower the generation gap, and thereby enhance firm performance.

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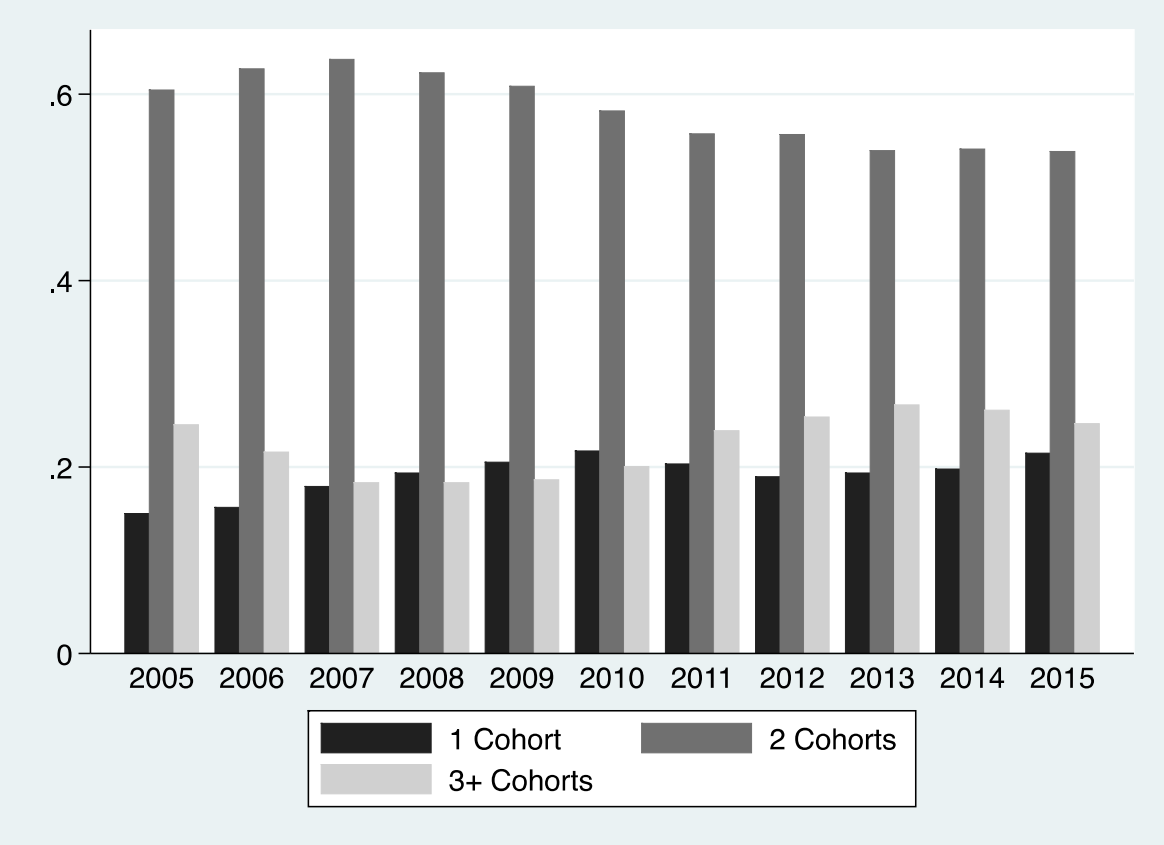
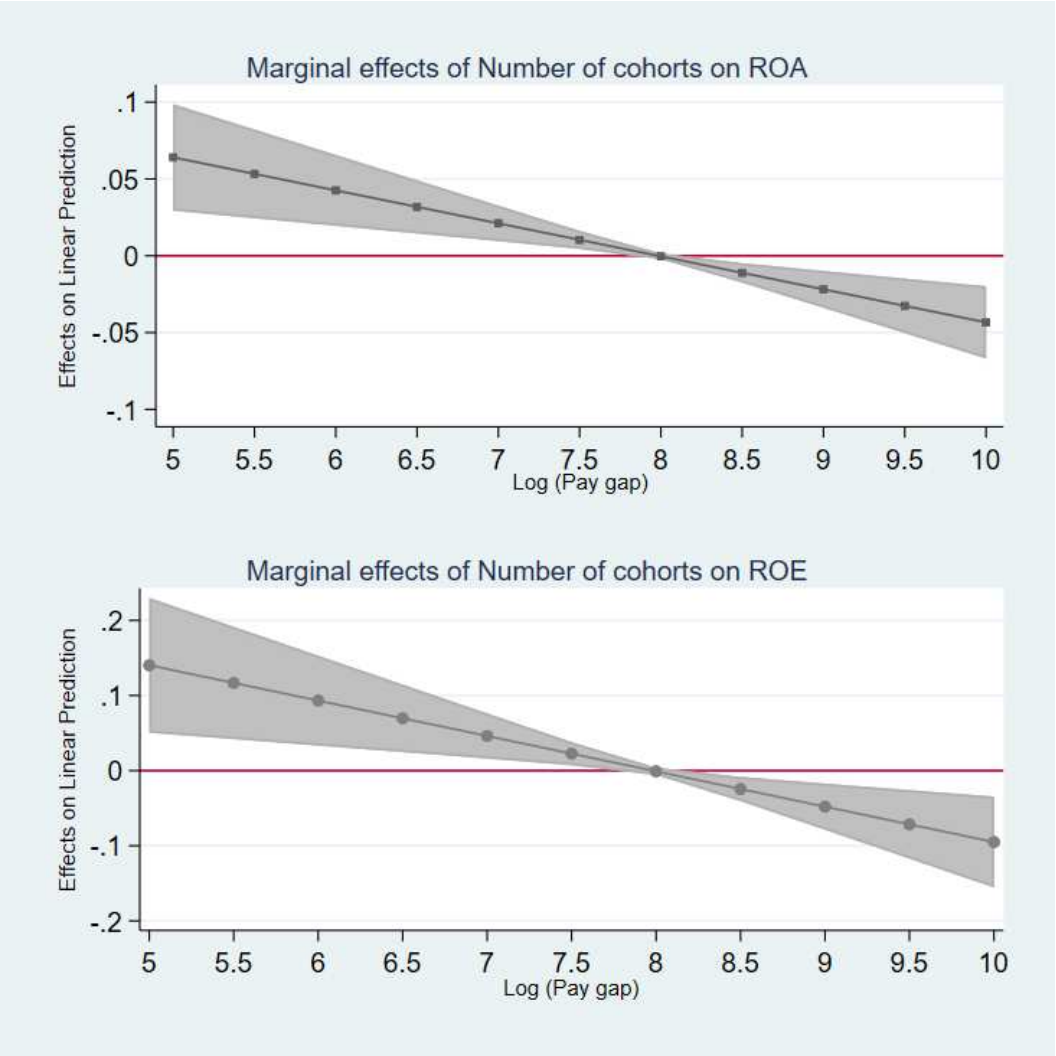
Figure 1 Distribution of age cohorts' composition for non-CEO executives in Chinese listed firms 2005-2015



This figure reports the percentage of firms with age cohorts' composition for non-CEO executives in Chinese listed firms from 2005 to 2015. The executives are divided into four age cohorts based on their birth year: 1931-1947 cohort, 1948-1958 cohort, 1959-1974 cohort and 1975-1992 cohort. 1 Cohort means that non-CEO executives are in the same cohorts. 2 Cohorts means that non-CEO executives are from any two different age cohorts. 3+ Cohorts refers to that non-CEO executives are from any three or more age cohorts.

Figure 2 Marginal effects of Number of cohorts at different levels of Pay gap



This figure shows the marginal effects of *Number of cohorts* on ROA/ROE at different levels of *Pay gap* holding other control variables at mean. The grey shaded area indicates 95% confidence intervals for *Number of cohorts*.

Table 1 Descriptive statistics

	Mean	Std	Lower quartile	Median	Upper quartile	Obs.
Panel A: Firm performance						
ROA	0.05	0.05	0.03	0.05	0.07	15,448
ROE	0.07	0.12	0.03	0.07	0.12	15,448
Panel B: Tournament incentives (000s CNY)						
CEO pay	601.33	690.51	260.30	439.05	705.58	15,448
Median non-CEO executive pay	396.97	363.43	192.00	310.00	486.00	15,448
Pay gap	204.36	447.01	44.00	108.00	232.17	15,448
$Pay\ Gap_1$	162.11	414.83	20.00	65.00	157.00	15,448
$Pay\ Gap_2$	195.31	428.24	40.32	109.60	226.28	15,448
Pay slice	1.50	0.74	1.17	1.36	1.67	15,448
Panel C: Age difference in non-CEO executives						
Number of Cohorts	2.05	0.68	2.00	2.00	2.00	15,448
2 Cohorts	0.58	0.49	0.00	1.00	1.00	15,448
3+ Cohorts	0.23	0.42	0.00	0.00	0.00	15,448
Age dissimilarity (>20)	0.32	0.47	0.00	0.00	1.00	15,448
CV	0.14	0.05	0.10	0.13	0.17	15,448
Panel D: Other characteristics						
Board size	2.18	0.20	2.08	2.20	2.20	15,448
Independent directors	0.37	0.05	0.33	0.33	0.40	15,448
Duality	0.20	0.40	0.00	0.00	0.00	15,448
Executives age	3.84	0.08	3.78	3.84	3.89	15,448
CEO age	3.87	0.13	3.78	3.87	3.95	15,448
Female executives	0.15	0.16	0.00	0.12	0.25	15,448
State	0.10	0.18	0.00	0.00	0.08	15,448
Foreign	0.01	0.06	0.00	0.00	0.00	15,448
Leverage	0.46	0.21	0.30	0.47	0.62	15,448
Firm size	21.90	1.27	21.01	21.73	22.58	15,448
Firm age	2.03	0.78	1.48	2.25	2.66	15,448

This table reports descriptive statistics on main variables for Chinese listed firms from 2005 to 2015. *ROA* is the ratio of the firm's net income to total assets. *ROE* is defined as the firm's net income divided by book value of total equity. *Pay gap* is the compensation gap between CEO and the median value of non-CEO executives. *CEO pay* is the total cash compensation for CEO. *Median non-CEO pay* is the median value of total cash remuneration for non-CEO executives. $Pay\ Gap_1$ is the compensation gap between the highest and second highest paid executive. $Pay\ Gap_2$ is the compensation gap between CEO and the mean value of the non-CEO executives. Pay slice is CEO pay to mean value of non-CEO executives' pay. *Number of cohorts* is the number of age cohorts among non-CEO executives. *2 Cohorts* equals to one if the non-CEO executives are from any two different age cohorts and zero otherwise. *3+ Cohorts* equals to one if the non-CEO executives are from any three or more different age cohorts and zero otherwise. *Age dissimilarity (>20)* equals to one if the age spread among non-CEO executives is larger than 20 and zero otherwise. CV is standard deviation of non-CEO executives ages divided by the mean age of non-CEO executives. *Board Size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of the CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since the initial public offering.

Table 2 Pay gap and firm performance

	ROA	ROE
	(1)	(2)
Log (Pay gap)	0.020***	0.056***
	(0.006)	(0.015)
Executives age	-0.008	-0.041
	(0.011)	(0.030)
Duality	-0.001	-0.005
	(0.002)	(0.005)
Independent directors	-0.002	0.003
	(0.015)	(0.038)
State	0.015***	0.044***
	(0.003)	(0.009)
Foreign	0.002	0.005
	(0.009)	(0.023)
Female executives	-0.000	-0.005
	(0.005)	(0.013)
Board size	-0.009	-0.025*
	(0.005)	(0.015)
CEO age	0.001	0.015
	(0.005)	(0.014)
Leverage	0.023***	0.074***
	(0.006)	(0.016)
Firm age	-0.001**	-0.001
	(0.001)	(0.002)
Firm size	-0.012***	-0.027***
	(0.002)	(0.005)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs.	15,448	15,448
R2	0.060	0.047

The table presents fixed effect regressions of firm performance on pay gap. The dependent variables are firm performance measured as *ROA* and *ROE*. *Log (Pay gap)* is the natural logarithm of the compensation gap between CEO and the median value of the non-CEO executives. *Board size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female executives* is the percentage of female executives. *CEO age* is the natural logarithm of the CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since the initial public offering. All the independent variables are one year lagged. Constants are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 3 Age diversity, pay gap and firm performance

	ROA	ROE	ROA	ROE
	(1)	(2)	(3)	(4)
Log (Pay gap)	0.065***	0.155***	0.057***	0.147***
	(0.015)	(0.039)	(0.011)	(0.032)
Number of cohorts	0.171***	0.376***		
	(0.047)	(0.122)		
Log (Pay gap) * Number of cohorts	-0.021***	-0.047***		
	(0.006)	(0.015)		
2 Cohorts			0.312***	0.820***
			(0.096)	(0.249)
3+ Cohorts			0.428***	0.973***
			(0.100)	(0.270)
Log (Pay gap) *2 Cohorts			-0.039***	-0.103***
			(0.012)	(0.031)
Log (Pay gap) * 3+ Cohorts			-0.054***	-0.122***
			(0.013)	(0.034)
Executives age	-0.009	-0.043	-0.010	-0.044
	(0.012)	(0.030)	(0.012)	(0.030)
Duality	-0.001	-0.005	-0.001	-0.005
	(0.002)	(0.005)	(0.002)	(0.005)
Independent directors	-0.002	0.005	-0.001	0.006
	(0.015)	(0.038)	(0.015)	(0.038)
State	0.015***	0.044***	0.015***	0.044***
	(0.003)	(0.009)	(0.003)	(0.009)
Foreign	0.002	0.005	0.002	0.005
	(0.009)	(0.023)	(0.009)	(0.023)
Female executives	-0.001	-0.005	-0.000	-0.005
	(0.005)	(0.013)	(0.005)	(0.013)
Board size	-0.009	-0.025*	-0.009	-0.025*
	(0.005)	(0.015)	(0.005)	(0.015)
CEO age	0.001	0.015	0.001	0.015
	(0.005)	(0.014)	(0.005)	(0.014)
Leverage	0.023***	0.074***	0.023***	0.075***
	(0.006)	(0.016)	(0.006)	(0.016)
Firm age	-0.002**	-0.002	-0.002**	-0.002
	(0.001)	(0.002)	(0.001)	(0.002)
Firm size	-0.012***	-0.027***	-0.013***	-0.028***
	(0.002)	(0.005)	(0.002)	(0.005)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs.	15,448	15,448	15,448	15,448
R2	0.061	0.047	0.062	0.048

The table presents fixed effect regressions of firm performance on pay gap and age cohorts. The dependent variables are firm performance measured as *ROA* and *ROE*. *Log (Pay gap)* is the natural logarithm of the compensation gap between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. *2 Cohorts* equals to one if the non-CEO executives are from any two different age cohorts and zero otherwise. *3+ Cohorts* equals to one if the non-CEO executives are from any three or more different age cohorts and zero otherwise. *Board size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since initial public offering. All the independent variables are one year lagged. Constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respective.

Table 4 Age diversity, pay gap and firm performance (seniority)

	ROA	ROE	ROA	ROE
	(1)	(2)	(3)	(4)
Log (Pay gap)	0.026***	0.068***	0.021***	0.045***
	(0.007)	(0.017)	(0.008)	(0.017)
One old	0.144**	0.303**		
	(0.069)	(0.149)		
Log (Pay gap) * One old	-0.018**	-0.038**		
	(0.009)	(0.019)		
Distance2			0.403**	0.393
			(0.180)	(0.328)
Distance3			1.969***	4.074***
			(0.449)	(1.244)
Log (Pay gap) * Distance2			-0.051**	-0.049
			(0.022)	(0.041)
Log (Pay gap) * Distance3			-0.247***	-0.478***
			(0.057)	(0.157)
Control variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs.	15,448	15,448	8,948	8,948
R2	0.061	0.047	0.061	0.051

The table presents fixed effect regressions of firm performance on pay gap and cohort difference measures. The dependent variables are firm performance measured as *ROA* and *ROE*. *Log (Pay gap)* the natural logarithm of the compensation gap between CEO and the median value of the non-CEO executives. *One old* equals to one if there is one executive in the oldest cohort within the firm. *Distance2* is equal to one, if executives are from 1931-1947 and 1959-1974 cohorts, or from 1948-1958 and 1975-1992 cohorts. *Distance3* is equal to one, if the executives are from 1931-1947 and 1975-1992 cohorts. All the independent variables are one year lagged. Constant and control variables are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 5 Subgroup analysis: Age diversity, pay gap and firm performance

Panel A: Descriptive statistics

	Non-state firms (N=11,606)		State firms (N=3,842)			**CEOs with overseas experience (N=815)**		CEOs without overseas experience (N=13,884)			**Other regions (N=12,371)**		North China Plain region (N=3,077)		
	Mean	**Std**	Mean	Std	P-value	**Mean**	**Std**	Mean	Std	P-	**Mean**	**Std**	Mean	Std	P-
Pay gap	217.561	470.892	130.078	263.462	0.000	332.754	672.475	188.738	412.995	0.000	199.594	441.837	172.574	362.230	0.000
No. of cohorts	2.072	0.711	2.000	0.607	0.000	2.052	0.685	2.053	0.685	0.979	2.053	0.691	2.050	0.665	0.803
CV	0.141	0.058	0.127	0.048	0.000	0.144	0.060	0.136	0.055	0.000	0.138	0.056	0.133	0.054	0.000
Dissimilarity	0.344	0.475	0.255	0.436	0.000	0.360	0.480	0.316	0.465	0.003	0.321	0.467	0.317	0.465	0.580
CEO age	47.912	6.683	48.138	5.663	0.032	46.752	7.903	48.032	6.317	0.000	47.953	6.498	48.050	6.132	0.404

Panel B: Age diversity, pay gap and firm performance

	Non-state firms		State firms		**CEOs with overseas experience**		CEOs without overseas experience		**Other regions**		North China Plain region	
	ROA	**ROE**	ROA	ROE	**ROA**	**ROE**	ROA	ROE	**ROA**	**ROE**	ROA	ROE
	(1)	**(2)**	(3)	(4)	**(5)**	**(6)**	(7)	(8)	**(9)**	**(10)**	(11)	(12)
Log (Pay gap)	0.038**	0.080**	0.104***	0.212**	0.007	0.010	0.071***	0.179***	0.056***	0.141***	0.125***	0.258***
	(0.016)	(0.034)	(0.036)	(0.089)	(0.051)	(0.078)	(0.016)	(0.043)	(0.017)	(0.046)	(0.031)	(0.071)
No. of cohorts	0.101*	0.185	0.247**	0.467*	0.073	0.146	0.182***	0.429***	0.141**	0.321**	0.346***	0.697***
	(0.052)	(0.115)	(0.110)	(0.275)	(0.159)	(0.255)	(0.053)	(0.138)	(0.056)	(0.146)	(0.085)	(0.207)
Log (Pay gap) * No. of cohorts	-0.013*	-0.023	-0.031**	-0.060*	-0.010	-0.020	-0.023***	-0.054***	-0.018**	-0.040**	-0.044***	-0.088***
	(0.006)	(0.014)	(0.014)	(0.034)	(0.020)	(0.032)	(0.007)	(0.017)	(0.007)	(0.018)	(0.011)	(0.026)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	11,606	11,606	3,842	3,842	815	815	13,884	13,884	12,371	12,371	3,077	3,077
R2	0.065	0.051	0.064	0.050	0.139	0.139	0.061	0.046	0.064	0.048	0.070	0.065

This table reports the subgroup analysis by state ownership, CEO overseas experience and cultural regions. Panel A presents the difference in summary statistics between non-state firms and state firms, between firms with CEOs who have overseas experience and firms with CEOs who have no overseas experience, and between firms located in the North China Plain region and firms located in other regions. The mean, standard deviation, the number of observations for sub-groups, and the p-value of the mean difference test are reported in Panel A, respectively. Panel B represents fixed effect regressions of firm performance on pay gap and the interaction between pay gap and age diversity for subgroups. The dependent variables are firm performance measured as *ROA* and *ROE*. *Log (Pay gap)* is the natural logarithm of the compensation difference between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. All the independent variables are one year lagged. For the sake of saving space, control variables and constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 6 Post-matching differences

	Treatment	Control	Difference	P-value
Log (Pay gap)	7.953	7.947	0.007	0.307
Executives age	3.817	3.816	0.000	0.979
Duality	0.175	0.212	-0.038	0.398
Independent directors	0.369	0.367	0.002	0.745
State	0.139	0.137	0.002	0.916
Foreign	0.015	0.010	0.004	0.604
Female executives	0.141	0.141	-0.000	0.987
Board size	2.150	2.178	-0.028	0.213
CEO age	3.843	3.860	-0.017	0.224
Leverage	0.453	0.463	-0.010	0.656
Firm age	1.666	1.637	0.030	0.832
Firm size	21.530	21.607	-0.077	0.552

This table reports the univariate comparisons of firm characteristics between matched treatment and control firm-year observations and the corresponding *t*-statistics. *Log (Pay gap)* is the compensation gap between CEO and the median value of non-CEO executives. *Board Size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of the CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since the initial public offering.

Table 7 Difference-in-difference estimation

	1 year before and after		2 years before and after	
	ROA	ROE	ROE	ROE
	(1)	(2)	(3)	(4)
Log (Pay gap)	0.078	0.326*	0.070**	0.169***
	(0.062)	(0.191)	(0.027)	(0.065)
Log (Pay gap) *Post*Treat	0.172**	0.516**	0.092*	0.280*
	(0.077)	(0.246)	(0.048)	(0.144)
Log (Pay gap) *Post	0.001	0.000	0.001*	0.002
	(0.001)	(0.002)	(0.001)	(0.002)
Treat*Post	-1.380**	-4.137**	-0.740*	-2.257*
	(0.614)	(1.962)	(0.384)	(1.154)
Log (Pay gap) *Treat	0.000	0.003	0.002	0.003
	(0.002)	(0.006)	(0.002)	(0.006)
Executives age	-0.050	-0.118	-0.044	-0.129
	(0.064)	(0.166)	(0.038)	(0.105)
Duality	-0.016	-0.047	0.002	0.004
	(0.012)	(0.030)	(0.007)	(0.021)
Independent directors	0.021	0.014	-0.004	-0.108
	(0.098)	(0.221)	(0.062)	(0.164)
State	-0.005	-0.067	0.003	-0.026
	(0.024)	(0.056)	(0.014)	(0.032)
Foreign	0.086	0.058	0.015	-0.036
	(0.090)	(0.161)	(0.057)	(0.107)
Female executives	-0.026	-0.117	-0.025	-0.075
	(0.029)	(0.085)	(0.021)	(0.058)
Board size	0.033	0.061	0.008	0.020
	(0.048)	(0.105)	(0.025)	(0.068)
CEO age	0.002	0.018	-0.049***	-0.139**
	(0.034)	(0.096)	(0.018)	(0.070)
Leverage	-0.120***	-0.382***	-0.093***	-0.230***
	(0.040)	(0.114)	(0.023)	(0.068)
Firm age	-0.009**	-0.003	-0.013***	-0.015*
	(0.004)	(0.009)	(0.003)	(0.008)
Firm size	0.006	0.003	0.006	0.024*
	(0.007)	(0.018)	(0.004)	(0.015)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs.	594	594	1068	1068
R2	0.178	0.159	0.159	0.126

This table reports the difference-in-difference estimation results. Columns (1) and (2) show the results one year before and after the treatment, while columns (3) and (4) show the results two years before and after the treatment. *Log (Pay gap)* is the natural logarithm of the compensation gap between CEO and the median value of the non-CEO executives. Treat is an indicator variable that equals to one for firms in the treatment group. Post is a dummy variable that equals one if the year is after the oldest non-CEO executive departure, and zero otherwise. *Board size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. CEO age is the natural logarithm of CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since initial public offering. Constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respective.

Table 8 Age diversity, pay gap and firm performance (System GMM)

	ROA	ROE
	(1)	(2)
ROA_{t-1}	0.629***	
	(0.118)	
ROE_{t-1}		0.808***
		(0.159)
Log (Pay gap)	0.357**	0.755*
	(0.177)	(0.400)
Number of cohorts	1.235*	2.590*
	(0.656)	(1.472)
Log (Pay gap) * Number of cohorts	-0.153*	-0.322*
	(0.082)	(0.184)
Executives age	0.068	0.136
	(0.072)	(0.163)
Duality	0.029	0.019
	(0.018)	(0.040)
Independent directors	-0.009	-0.051
	(0.088)	(0.215)
State	0.109	0.431**
	(0.078)	(0.176)
Foreign	-0.513**	-1.312***
	(0.218)	(0.485)
Female executives	0.013	-0.018
	(0.034)	(0.087)
Board size	0.001	-0.068
	(0.037)	(0.084)
CEO age	-0.002	0.011
	(0.050)	(0.139)
Leverage	-0.048*	-0.124**
	(0.025)	(0.057)
Firm age	0.002	0.001
	(0.004)	(0.010)
Firm size	0.003	0.002
	(0.004)	(0.013)
Year FE	Yes	Yes
Obs.	15,459	15,459
AR (2) (p-value)	0.582	0.176
Hansen test (p-value)	0.176	0.395

The table presents the system GMM regression of firm performance on pay gap and the interaction between pay gap and age diversity. The dependent variables are firm performance measured as *ROA* and *ROE*. *Log (Pay gap)* is the natural logarithm of the compensation difference between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. *Board Size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. Foreign is *the* proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since initial public offering. All the independent variables (except ROA_{t-1}, ROE_{t-1} and EPS_{t-1}) are not lagged. Constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 9 Tournament incentives, age diversity and risk

	Stock return volatility	Stock return volatility
	(1)	(2)
Log (Pay gap)	0.541**	0.394**
	(0.259)	(0.201)
Number of cohorts	2.074**	
	(0.963)	
Log (Pay gap) * Number of cohorts	-0.260**	
	(0.121)	
2 Cohorts		3.257*
		(1.661)
3+ Cohorts		5.012**
		(1.961)
Log (Pay gap) *2 Cohorts		-0.411**
		(0.209)
Log (Pay gap) * 3+ Cohorts		-0.629**
		(0.246)
Duality	0.039	0.038
	(0.026)	(0.026)
Independent directors	-0.275	-0.275
	(0.185)	(0.185)
State	0.090**	0.091**
	(0.042)	(0.042)
Foreign	-0.048	-0.050
	(0.147)	(0.147)
Female executives	0.031	0.031
	(0.071)	(0.071)
Board size	0.011	0.012
	(0.064)	(0.065)
CEO age	-0.043	-0.044
	(0.069)	(0.069)
Executive age	0.072	0.082
	(0.147)	(0.147)
ROA	1.019***	1.017***
	(0.159)	(0.159)
Leverage	0.007	0.010
	(0.074)	(0.074)
Firm age	-0.011	-0.011
	(0.015)	(0.015)
Tobin's Q	0.001	0.001
	(0.007)	(0.007)
Firm size	-0.080***	-0.081***
	(0.021)	(0.021)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs.	15448	15448
R2	0.623	0.623

The table presents fixed effect regressions of firm risk on pay gap and age cohorts. The dependent variables are firm risks measured as *Daily stock return volatility. Log (Pay gap)* is the natural logarithm of the compensation gap between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. *Board size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *2 Cohorts* equals to one if the non-CEO executives are from any two different age cohorts and zero otherwise. *3+ Cohorts* equals to one if the non-CEO executives are from any three or more different age cohorts and zero otherwise. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *ROA* is net income to total assets. *Tobins' Q* is the market value of assets divided by the book value of assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since initial public offering. All the independent variables are one year lagged. Constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respective.

Table 10 Subgroups analysis: Tournament incentives, age diversity and risk

	Stock return volatility		**Stock return volatility**		**Stock return volatility**	
	Non-state firms	State firms	Without overseas CEO	With overseas CEO	Other regions	North China Plain region
	(1)	(2)	(3)	(4)	(5)	(6)
Pay gap	0.323	1.697***	0.539*	0.951	0.494*	0.921
	(0.294)	(0.580)	(0.285)	(0.840)	(0.282)	(0.783)
Number of cohorts	1.529	5.747***	2.011*	4.329	1.999*	2.831
	(1.106)	(1.933)	(1.047)	(2.852)	(1.113)	(2.306)
Pay gap * Number of cohorts	-0.191	-0.725***	-0.252*	-0.547	-0.250*	-0.356
	(0.139)	(0.243)	(0.131)	(0.356)	(0.140)	(0.290)
Duality	0.056*	-0.021	0.022	0.268*	0.039	0.028
	(0.031)	(0.059)	(0.027)	(0.150)	(0.029)	(0.058)
Independent directors	0.193	-1.176***	-0.246	-0.706	-0.245	-0.312
	(0.242)	(0.341)	(0.189)	(1.434)	(0.208)	(0.399)
State	0.047	0.207**	0.104**	-0.264	0.114**	0.016
	(0.056)	(0.086)	(0.045)	(0.261)	(0.047)	(0.094)
Foreign	-0.159	0.976*	-0.112	0.206	-0.049	-0.027
	(0.160)	(0.563)	(0.178)	(0.286)	(0.154)	(0.490)
Female directors	0.104	-0.117	-0.038	0.196	0.005	0.153
	(0.087)	(0.146)	(0.076)	(0.415)	(0.077)	(0.183)
Board size	0.072	-0.163	0.022	-0.061	0.018	0.009
	(0.087)	(0.101)	(0.067)	(0.431)	(0.072)	(0.147)
CEO age	-0.011	-0.202	-0.085	-0.082	-0.065	0.048
	(0.087)	(0.126)	(0.076)	(0.340)	(0.075)	(0.174)
Mean age	0.120	0.050	0.027	1.753*	-0.035	0.661*
	(0.187)	(0.300)	(0.157)	(0.991)	(0.162)	(0.343)
ROA	1.136***	0.514*	1.010***	0.873	0.738***	2.427***
	(0.205)	(0.297)	(0.169)	(1.009)	(0.174)	(0.385)
Leverage	-0.121	0.111	0.022	-0.256	-0.073	0.392**
	(0.098)	(0.147)	(0.079)	(0.447)	(0.081)	(0.184)
Firm age	-0.012	0.063*	-0.010	-0.053	-0.011	-0.011
	(0.018)	(0.033)	(0.016)	(0.060)	(0.017)	(0.034)
Tobin's Q	0.001	-0.024*	0.007	-0.034	0.004	-0.017
	(0.009)	(0.013)	(0.008)	(0.033)	(0.008)	(0.015)
Firm size	-0.103***	-0.068*	-0.083***	0.004	-0.056**	-0.201***
	(0.029)	(0.041)	(0.022)	(0.138)	(0.023)	(0.049)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	11606	3842	13884	815	12371	3077
R2	0.594	0.663	0.624	0.560	0.627	0.613

This table reports fixed effect regressions of firm risk on pay gap and the interaction between pay gap and age diversity for subgroups (state ownership, CEO overseas experience and cultural regions). *Pay gap* is the natural logarithm of the compensation difference between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. *Board size* is the natural logarithm of the number of board directors. *Independent directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *ROA* is net income to total assets. *Tobins' Q* is the market value of assets divided by the book value of assets. *Firm age* is the natural logarithm of the number of years since initial public offering. All the independent variables are one year lagged. Constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 11 Pay gap and firm performance: Residualized pay gap

	ROA	ROE
	(1)	(2)
Log (Pay Gap) $_{residualized}$	0.020***	0.055***
	(0.006)	(0.015)
Executives age	-0.008	-0.040
	(0.011)	(0.030)
Duality	-0.001	-0.005
	(0.002)	(0.005)
Independent directors	-0.002	0.003
	(0.015)	(0.038)
State	0.015***	0.044***
	(0.003)	(0.009)
Foreign	0.002	0.005
	(0.009)	(0.023)
Female directors	-0.000	-0.005
	(0.005)	(0.013)
Board size	-0.009	-0.025*
	(0.005)	(0.015)
CEO age	0.001	0.015
	(0.005)	(0.014)
Leverage	0.023***	0.074***
	(0.006)	(0.016)
Firm age	-0.001**	-0.001
	(0.001)	(0.002)
Firm size	-0.012***	-0.027***
	(0.002)	(0.005)
Year FE	Yes	Yes
Firm FE	Yes	Yes
Obs.	15,448	15,448
R2	0.060	0.047

The table presents fixed effect regressions of firm performance on residualized pay gap. The dependent variables are firm performance measured as *ROA* and *ROE*. $Log\ (Pay\ Gap)_{residualized}$ is the natural logarithm of the residualised compensation gap between CEO and the median value of the non-CEO executives. *Board Size* is the natural logarithm of the number of board directors. *Independent Directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO Age* is the natural logarithm of the CEO age. *Executives age* is the average age of non-CEO executives. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Firm size* is the natural logarithm of total assets. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since the initial public offering. All the independent variables are one year lagged. Constants are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 12 Family firms vs. non-family firms

Panel A: Descriptive statistics					
	Non-family firms (N=13,288)		Family firms (N=2,160)		
	Mean	Std	Mean	Std	P-value
	(1)	(2)	(3)	(4)	(5)
Pay gap	197.054	430.514	178.311	408.371	0.030
Number of cohorts	2.043	0.678	2.107	0.725	0.000
CV	0.135	0.054	0.148	0.060	0.000
Dissimilarity (>20 years)	0.310	0.462	0.379	0.485	0.000
CEO age	48.118	6.366	47.162	6.701	0.000

Panel B: Age diversity, pay gap and firm performance				
	Non-family firms		Family firms	
	ROA	ROE	ROA	ROE
	(1)	(2)	(3)	(4)
Log (Pay gap)	0.065***	0.163***	0.075	0.104
	(0.016)	(0.042)	(0.051)	(0.105)
Number of cohorts	0.171***	0.386***	0.159	0.243
	(0.050)	(0.133)	(0.132)	(0.286)
Log (Pay gap) * Number of cohorts	-0.021***	-0.048***	-0.020	-0.031
	(0.006)	(0.017)	(0.017)	(0.036)
Control variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs.	13,288	13,288	2,160	2,160
R2	0.064	0.050	0.084	0.074

This table reports the subgroup analysis by family ownership. Panel A presents the difference in summary statistics between non-family firms and family firms. Panel B represents fixed effect regressions of firm performance on pay gap and the interaction between pay gap and age diversity for family firms and non-family firms. The dependent variables are firm performance measured as *ROA* and *ROE*. *Log (Pay gap)* is the natural logarithm of the compensation difference between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. All the independent variables are one year lagged. For the sake of saving space, control variables and constant are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Table 13 Age diversity, pay gap and firm performance: Alternative measures

Panel A: Alternative age diversity measures				
	Age dissimilarity (>20 years)		CV	
	ROA	ROE	ROA	ROE
	(1)	(2)	(3)	(4)
Log (Pay gap)	0.028***	0.069***	0.048***	0.119***
	(0.007)	(0.018)	(0.015)	(0.040)
Age dissimilarity (>20)	0.156**	0.278*		
	(0.068)	(0.143)		
Log (Pay gap) * Age dissimilarity (>20)	-0.020**	-0.035*		
	(0.008)	(0.018)		
CV			1.671**	3.876**
			(0.745)	(1.923)
Log (Pay gap) *CV			-0.209**	-0.482**
			(0.093)	(0.241)
Control variables	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Obs.	15,448	15,448	15,448	15,448
R2	0.061	0.047	0.061	0.047

Panel B: Alternative pay gap measures						
	Log (Pay gap_1)		Log (Pay gap_2)		Pay slice	
	ROA	ROE	ROA	ROE	ROA	ROE
	(1)	(2)	(3)	(4)	(5)	(6)
Log (Pay gap_1)	0.003***	0.007***				
	(0.001)	(0.003)				
Log (Pay gap_2)			0.061***	0.144***		
			(0.017)	(0.043)		
Pay slice					0.039**	0.060
					(0.018)	(0.047)
Number of cohorts	0.004**	0.008	0.167***	0.364**	0.004**	0.005
	(0.002)	(0.005)	(0.056)	(0.146)	(0.002)	(0.005)
Log (Pay gap_1)* Number of cohorts	-0.001**	-0.002**				
	(0.000)	(0.001)				
Log (Pay gap_2)* Number of cohorts			-0.021***	-0.045**		
			(0.007)	(0.018)		
Pay slice *Number of cohorts					-0.018**	-0.021
					(0.009)	(0.022)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	13,750	13,750	15,448	15,448	15,448	15,448
R2	0.061	0.047	0.061	0.047	0.060	0.045

The table presents the fixed effect regressions of firm performance on pay gap and the interaction between pay gap and age diversity with alternative measures. The dependent variables are firm performance measured as *ROA* and *ROE*. In Panel A, age diversity is measured by *Age dissimilarity (>20)*, a dummy variable that equals to one if the age spread among non-CEO executives is larger than 20 and zero otherwise and by CV, defined as standard deviation of non-CEO executives ages divided by the mean age of non-CEO executives. In Panel B, pay gap is measured by *Log (*$Pay\ gap_1$*),* the log difference between CEO pay and the mean value of non-CEO executive pay; *Log (*$Pay\ gap_2$*),* the pay difference between the highest and the second highest executives; and *Pay slice*, the fraction of CEO pay to the mean value of non-CEO executive pay. All the independent variables are one year lagged. Constant and control variables are included into the estimation but not reported. The robust standard errors clustered by firm are reported in parentheses. *, **, *** indicate statistical significance level at 10%, 5%, and 1%, respectively.

Appendix A Variables definition

Variable	Definition
Panel A: Firm performance	
ROA	Net income/ total assets
ROE	Net income/ book value of total equity
Panel B: Tournament incentives (000s CNY)	
Pay gap	Compensation of CEO - median value of compensation of non-CEO executives
$Pay\ Gap_1$	Compensation of highest paid executive - compensation of second highest paid executive
$Pay\ Gap_2$	Compensation of CEO - mean value of compensation of non-CEO executives
Pay slice	Compensation of CEO /mean value of compensation of non-CEO executives
Panel C: Age difference in non-CEO executives	
Number of Cohorts	Number of age cohorts among non-CEO executives
1 Cohort	Dummy variable equals one if non-CEO executives are in the same age cohort (generation) and zero otherwise
2 Cohorts	Dummy variable equals one if non-CEO executives are from any two different cohorts (generations) and zero otherwise
3+ Cohorts	Dummy variable equals one if non-CEO executives are from any three or more different age cohorts (generations) and zero otherwise
Age dissimilarity (>20)	Dummy variable equals one if the age spread in non-CEO executives is larger than 20 years and zero otherwise
CV	Standard deviation of non-CEO executives' age / mean age of non-CEO executives' age
Panel D: Other characteristics	
State	Percentage of shares held by the government or state-owned enterprise
Foreign	Percentage of shares held by foreign investors
Independent directors	Percentage of independent directors
Duality	Dummy variable equals one if the CEO is also the chairman of the board and zero otherwise
Executive Age	The natural logarithm of average age of non-CEO executives
CEO Age	The natural logarithm of CEO age
Female executives	Percentage of female executives
Board size	The natural logarithm of board size
Leverage	Total debt/total assets
Firm size	The natural logarithm of total assets
List Age	The natural logarithm of the number of years since the firm has been listed

Appendix B Distribution of firms with equity incentives by year

Year	Percentage of firms granted equity incentives to executives
2006	1.07%
2007	0.53%
2008	1.71%
2009	0.71%
2010	2.02%
2011	5.05%
2012	6.11%
2013	7.18%
2014	8.35%
2015	9.26%

This table shows the percentage of firms that granted equity-based incentives (restricted stock or stock options) to executives from during our sample period.

Appendix C Summary statistics by different levels of age diversity

	Small pay gap			**Medium pay gap**			**Large pay gap**		
	1 cohort (949)	2 cohorts (2,840)	3+ cohorts (1,045)	1 cohort (1,088)	2 cohorts (3,038)	3+ cohorts (1,077)	1 cohort (938)	2 cohorts (3,015)	3+ cohorts (1,458)
	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean
ROA	3.54%	4.15%	4.46%	4.65%	5.00%	4.87%	6.21%	6.16%	5.97%
ROE	2.98%	4.87%	5.30%	5.96%	7.05%	6.56%	10.84%	10.02%	9.09%

This table reports firm performance for firms with different levels of age diversity conditional on small, medium and large pay gap. ROA is the ratio of the firm's net income to total assets. ROE is defined as the firm's net income divided by book value of total equity.

Appendix D Correlation of main variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.ROA	1.000														
2.ROE	**0.849**	1.000													
3.Pay gap	**0.127**	**0.152**	1.000												
4.Number of Cohorts	**0.013**	**0.015**	**0.036**	1.000											
5.Executives age	**-0.033**	**-0.014**	**0.016**	**0.178**	1.000										
6.Duality	**0.056**	**0.026**	**0.074**	**-0.044**	**-0.159**	1.000									
7.Independent directors	**-0.014**	-0.004	0.003	0.003	**-0.017**	**0.101**	1.000								
8.State	**-0.012**	0.008	**-0.105**	**-0.051**	**0.021**	**-0.153**	**-0.098**	1.000							
9.Foreign	**0.058**	**0.038**	**0.035**	**0.043**	**-0.021**	**0.039**	0.0110	-0.055	1.000						
10.Female executives	**0.022**	**0.013**	**0.072**	**0.024**	**-0.119**	**0.112**	**0.032**	**-0.107**	0.0120	1.000					
11.Board size	**0.017**	**0.027**	**0.021**	**0.008**	**0.121**	**-0.167**	**-0.416**	**0.196**	**-0.025**	**-0.095**	1.000				
12.CEO age	**-0.004**	**0.008**	**0.098**	**-0.039**	**0.250**	**0.155**	**0.026**	**0.009**	**0.006**	**-0.007**	**0.043**	1.000			
13.Leverage	**-0.300**	**-0.194**	**0.011**	**-0.017**	**0.090**	**-0.181**	**-0.031**	**0.130**	**-0.098**	**-0.098**	**0.166**	**0.009**	1.000		
14.Firm age	**-0.234**	**-0.148**	**0.020**	**-0.046**	**0.199**	**-0.222**	**-0.029**	**0.027**	**-0.184**	**-0.016**	**0.076**	**0.064**	**0.415**	1.000	
15.Firm size	**0.049**	**0.144**	**0.193**	0.014	**0.286**	**-0.141**	**0.047**	**0.087**	**-0.049**	**-0.132**	**0.246**	**0.154**	**0.419**	**0.270**	1.000

This table shows the correlation matrix of main variables. *ROA* is the net income divided by total assets. *ROE* is the net income to book value of total equity. *Pay gap* is the compensation gap between CEO and the median value of the non-CEO executives. *Number of cohorts* is the number of age cohorts among non-CEO executives. *Executives Age* is the average age of non-CEO executives. *Board Size* is the natural logarithm of the number of board directors. *Independent Directors* is the percentage of independent directors. *Duality* is a dummy variable which equals one if the CEO is also the chairman and zero otherwise. *Female Executives* is the percentage of female executives. *CEO age* is the natural logarithm of the CEO age. *State* is the proportions of shares owned by state-owned enterprises/central/local governments. *Foreign* is the proportions of shares owned by foreign investors. *Leverage* is defined as the ratio of debt to total assets. *Firm age* is the natural logarithm of the number of years since the initial public offering. *Firm size* is the natural logarithm of total assets. Figures in bold are significant at 5% level.