Do young CEOs matter for corporate digital transformation?

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Abstract

This paper investigates the empirical relation between CEO age and corporate digital transformation. Using a sample of Chinese listed firms from 2007 to 2022, we find that young CEOs exhibit a higher propensity to engage in digital transformation when compared to older CEOs. We pinpoint two key driving factors behind this phenomenon: CEOs' motivation to establish a good reputation and their willingness to embrace failure. Furthermore, our heterogeneity tests show that the negative relation between CEO age and digital transformation does not vary with firms' state ownership, but is more pronounced among firms with fewer financial constraints. Overall, our finding contributes to the growing body of literature examining how CEO characteristics influence digital transformation.

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1. Introduction

With the continuous evolution of mobile internet technology and the wide adoption of 5G mobile communication, the global digital economy driven by innovations such as artificial intelligence, blockchain, cloud computing, and big data is thriving. Digital transformation is a systematic process in which firms use digital technology to reshape their business models, enhance production efficiency, and ultimately improve their core competitiveness (Vial, 2019; Verhoef et al., 2021; Fan and Xu, 2023). Numerous firms have initiated their journey toward digital transformation (Chen et al., 2023; Dou et al., 2023; Genz and Schnabel, 2023; Duan and Sandhu, 2023). Consequently, understanding the factors influencing corporate digital transformation is of great importance. In this paper, we investigate the potential impact of CEO age on a firm's decision to embark on digital transformation and explore the underlying mechanisms behind this relation.

Existing research on corporate digital transformation predominantly focuses on internal and external factors. Internally, Internally, digital transformation is intricately linked with factors such as corporate culture (Karimi and Walter, 2015), organizational structure (Vial, 2019), and resource availability (Karimi and Walter, 2015; Mo and Liu, 2023). Externally, business environments such as technology development (Ramaswamy and Ozcan, 2016; Teece, 2018) and government tax incentives (Chen et al., 2023) are also crucial prerequisites for successful digital transformation.

CEOs exert profound influence over corporate decision-making processes. To the best of our knowledge, our paper is the first to explore the relation between CEO traits and corporate digital transformation. Our specific focus is on CEO age, as previous studies have highlighted the important role of young CEOs in various corporate activities such as external financing (Cronqvist et al., 2012), acquisitions (Yim, 2013; Jenter and Lewellen, 2015), investment (Serfling, 2014; Li et al., 2017), information disclosure (Andreou et al., 2017), and strategic changes (Gillan et al., 2021). All of these corporate activities have the potential to catalyze and facilitate corporate digital transformation.

Drawing upon a sample of Chinese listed firms spanning the period from 2007 to 2022, we document a negative relation between CEO age and corporate digital transformation. The negative relation remains robust to a battery of identification tests: the Oster test, propensity score matching (PSM), entropy balancing (EB) matching, an instrumental variable (IV) estimator, a difference-in-differences (DID) estimator, and higher dimensional fixed effects models. Furthermore, we examine the underlying mechanisms responsible for the influence of CEO age on digital transformation. We find evidence that CEO reputation establishment and tolerance for failure play significant roles in shaping this dynamic. Lastly, we observe that the negative relation between CEO age and digital transformation is more pronounced among firms with fewer financial constraints.

Our paper contributes to the existing literature in three distinct ways. First, it enhances our understanding of the determinants of corporate digital transformation, offering insights for corporate boards seeking to foster digitalization. While previous studies have examined the influence of both internal factors (Mo and Liu, 2023; Chen et al., 2023) and external business environments (Teece, 2018; Verhoef et al., 2021) on digital transformation, our study is the first to examine the role of young CEOs in this context. Second, our study adds to the growing body of research centered on the influence of CEO age on corporate decision-making. By investigating the role of young CEOs in digital transformation, our work adds a valuable dimension to this field of knowledge. Lastly, we reveal the underlying mechanisms through which young CEOs drive digital transformation, shedding light on their motivations behind embracing riskier corporate strategies. This provides essential insights into their role as catalysts for digitalization within corporations.

The structure of this paper is as follows. In Section 2, we present the literature review and hypothesis. Section 3 outlines our research design. Section 4 describes the results of our baseline regression and identification tests. In Section 5, we discuss mechanism tests and heterogeneity analysis. Section 6 concludes the paper.

2. Literature review and hypothesis

2.1 Literature review

2.1.1 Corporate digital transformation

Digital transformation has emerged as an important corporate strategy in pursuit of new growth opportunities. Firms stand to gain numerous advantages from embracing digital transformation, including the streamlining of operations (Vial, 2019), the reduction of transaction costs (Goldfarb and Tucker, 2019), and the enhancement of innovation efficiency (Chen and Srinivasan, 2023). However, while these benefits are substantial, the adoption of corporation-wide digital transformation requires significant investments, and the full return on these investments is typically a longer-term endeavor (Mo and Liu, 2023).

Previous studies have identified several key drivers of corporate digital transformation. Internally, firms with an innovative culture (Karimi and Walter, 2015), and a willingness to take calculated risks (Vial, 2019) are more likely to embrace digital transformation due to its inherent uncertainties. Furthermore, a flexible and agile organizational structure, facilitating effective cross-functional collaboration (Vial, 2019), is vital to adapt to the demands of digitalization swiftly. Adequate financial support (Mo and Liu, 2023), essential digital resources (Karimi and Walter, 2015), and employees with digital skills (Teece, 2018; Dou et al., 2023) are also crucial prerequisites for successful digital transformation.

From an external perspective, the business environment plays a pivotal role in shaping a firm's digital transformation journey. The dynamics of technological changes in society drive firms to actively seek out development opportunities and invest in digital transformation (Ramaswamy and Ozcan, 2016; Teece, 2018). Government policies, such as tax incentives and credit preferences (Chen et al., 2023), further incentivize firms to engage in digital transformation. Furthermore, industrial competition and market uncertainties exert significant influence on digital transformation decisions. For example, firms operating in highly competitive industries are more inclined to pursue digital transformation to maintain their market competitiveness (Verhoef et al., 2021).

2.1.2 CEO age and corporate activities

Previous studies emphasize the importance of reputation for young CEOs in the executive job market, illustrating their inclination to showcase their competence by engaging in activities that enhance their public image. For example, young CEOs often prioritize corporate social responsibility initiatives and allocate resources to environmental, social, and governance practices to bolster their reputation (Borghesi et al., 2014; Oh et al., 2016).

Furthermore, young CEOs, buoyed by longer career horizons that allow them to rebound from setbacks and capitalize on future opportunities, tend to adopt riskier corporate strategies. Previous studies show that firms with younger CEOs tend to allocate more resources to research and development (Serfling, 2014; Li et al., 2017), employ higher leverage (Serfling, 2014), and face greater future stock price crash risk (Andreou et al., 2017). In contrast, older CEOs often exhibit a more conservative disposition and are generally averse to taking significant risks. Consequently, firms with older CEOs tend to maintain larger cash reserves (Bertrand and Schoar, 2003) and exhibit better quality financial information disclosure practices (Huang et al., 2012).

Divergent corporate decisions associated with CEO age may also stem from agency problems. As CEOs age, they become more entrenched in their positions, resulting in either a preference for quiet life (Child, 1974; Hambrick and Mason, 1984) or opportunistic behaviors (Allgood and Farrell, 2000; Yim, 2013). For example, CEOs nearing retirement may resort to income-boosting earnings management practices, such as reducing advertising expenses and manipulating discretionary accruals (Reitenga and Tearney, 2003; Kalyta, 2009; Chen et al., 2018).

Considering the discussed benefits and potential risks associated with corporate digital transformation in Section 2.1.1, it is important to understand how CEO age affects a firm’s decision to adopt digital transformation.

2.2 Hypothesis

We posit that the CEO age has an impact on corporate digital transformation due to the following three reasons. First, young CEOs are more inclined to undertake strategic changes such as acquisitions (Yim, 2013) and venturing into new business initiatives (Li et al., 2017) to establish their reputation in the labor markets. Digital transformation, being a strategic shift that enhances a firm’s performance and attracts external attention, also presents an opportunity for young CEOs to bolster their reputation in the labor market.

Second, young CEOs typically exhibit a greater tolerance for failure, attributed to their longer careers and the potential for future success (Gao, 2010; Cho and Kim, 2017). Since digital transformation is a risky and challenging corporate activity that demands substantial investments in both human resources and capital equipment (Mo and Liu, 2023), young CEOs may be more inclined to embrace such activities, despite the inherent uncertainty.

Third, the impact of CEO age on digital transformation may be linked to agency problems. As CEOs get older, they tend to become more entrenched in their positions, potentially giving rise to agency issues (McClelland et al., 2012). Dechow et al. (1991) show that firms with older CEOs are more prone to earnings management. Therefore, older CEOs may be less inclined to allocate significant resources to digital transformation. Taken together, we propose the following hypothesis:

Hypothesis 1*. CEO age is negatively related to corporate digital transformation.*

3. Research design

3.1 Samples and data

In this paper, we utilize the data from A-share firms listed on both the Shanghai Stock Exchange and Shenzhen Stock Exchange, spanning the period from 2007 to 2022. Our dataset is sourced from the China Stock Market & Accounting Research (CSMAR) database. We adopt the following sample selection criteria. First, we exclude financial firms and ST (Special Treatment) firms. Second, we exclude firms with a listing history of fewer than three years during our sample period. Third, we exclude observations with missing variables for our empirical tests. Our final sample consists of 2,829 listed firms and 26,402 firm-year observations. To mitigate the potential influence of outliers, we winsorize all continuous variables at the 1% and 99% levels.

3.2 Corporate digital transformation

Following prior studies (Mo and Liu, 2023; Chen et al., 2023; Chen and Srinivasan, 2023), we measure a firm's commitment to digital transformation by examining the presence of digital transformation-related keywords within its annual reports. We conduct textual analysis with Python to construct a proxy variable for corporate digital transformation, following these steps. First, we compile a comprehensive list of digital transformation keywords from the existing literature (Zhou and Li, 2023; Zhang et al., 2023), as well as the official government website.[1] These keywords (in English) are listed in Appendix Table A2. Second, we conduct textual analysis on the annual reports of listed firms using machine learning methods. Through this process, we quantify the frequency of vocabulary related to digitalization in these reports. Finally, we derive a proxy variable (*DCG*) for corporate digital transformation, by taking the natural logarithmic form of the frequency of digitalization keywords. A higher value of *DCG* indicates a greater degree of corporate digital transformation.

3.3 Model specification

To examine the influence of CEO age on corporate digital transformation, we estimate the following regression model:

$$DCG_{i,t+1} = \alpha + \beta CEOage_{i,t} + \gamma Controls_{i,t} + \mu_i (\text{or } \eta_j + \nu_p) + \theta_t + \varepsilon_{i,t} \quad (1)$$

where $DCG_{i,t+1}$ represents the level of digital transformation for firm i in year t+1, while the variable of interest $CEOage_{i,t}$ is the natural logarithm of a CEO's age for firm i in

[1] Please refer to: https://www.miit.gov.cn/

year t.[2] In line with prior literature on corporate digital transformation (Chen et al., 2023; Mo and Liu, 2023), we incorporate a set of firm and CEO characteristics as control variables that may be associated with corporate digital transformation. Specifically, we control for CEO gender (*Gender*), CEO tenure (*Tenure*), CEO salary (*Salary*), CEO shareholding (*Share*), firm size (*Size*), firm investment opportunity (*Q*), profitability (*Roe*), capital structure (*Leverage*), total sales (*Sales*), firm age (*Firmage*), audit quality (*Big4*), ownership structure (*Top1*), and CEO-chair duality (*Dual*). To address concerns of reverse causality, all explanatory variables are lagged by one year. Detailed variable definitions are summarized in Appendix Table A1. We also control for the year (θ_t) and firm (μ_i) fixed effects or year (θ_t), industry (η_j), and province (v_p) fixed effects in Equation (1).

A negative regression coefficient β implies that young CEOs are more likely to engage in corporate digital transformation, leading support to our hypothesis.

4. Empirical results

4.1 Descriptive statistics

We present the descriptive statistics in Table 1. The mean and standard deviation of *DCG* are 1.161 and 1.378, indicating that our sample firms do exhibit variations in their digital transformation. CEO age varies from 26 ($e^{3.258}$) to 81 ($e^{4.394}$), with a mean value of 49 ($e^{3.889}$), indicating significant variation in the ages of CEOs across our sample. The distribution of control variables aligns with those reported in existing research (e.g., Chen et al., 2023; Mo and Liu, 2023).

4.2 Main results

Table 2 presents the results of our baseline regression. In column (1), the coefficient of *CEOage* is negative and statistically significant at the 1% level. This finding indicates that firms with younger CEOs are more likely to pursue corporate digital transformation, lending support to our hypothesis. In columns (2) to (4), we control for firm and CEO characteristics, as well as fixed effects, the coefficients of *CEOage* remain negative and statistically significant, reinforcing the robustness of our main finding. Moreover, the impact of CEO age on corporate digital transformation is economically important. Taking column (4) as an example, for a 1% increase in *CEOage*, digital transformation decreases by 0.21% (0.01×0.2382/1.161) at the mean.

Regarding the coefficients of control variables, firms with more CEO ownership (*Share*), larger size (*Size*), greater investment opportunities (*Q*), lower leverage (*Lev*), and less ownership concentration (*Top1*) are more likely to engage in digital transformation.

4.3 Identification tests

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[2] For robustness checks, we adopt two alternative measures of CEO age and re-estimate our baseline regression. First, we construct a binary CEO age variable (*CEOage1*) that equals 1 if a CEO's age is higher than the median age of CEOs within the same industry and 0 otherwise. Second, we construct a category CEO age variable (*CEOage2*) with a base value of 0 and increments of 1 for every 10-year increase in CEO age beyond the minimum age in our sample. As CEO ages in our sample range from 26 to 81, *CEOage2* varies between 0 and 6. Untabulated results show that our main finding is robust.

4.3.1 Oster's coefficient stability test

Oster (2019) proposes a coefficient stability test to evaluate the potential impact of omitted variable bias in regression analysis. In Table 3, row (1) shows the estimated coefficient of *CEOage* in our baseline regression (column (3) in Table 2). Building upon Oster's approach, we assume that the selection on unobserved confounding variables is proportionate to the selection on observed confounders ($\delta=1$). We also define the upper bound (R_{max}) as 1.3 times the R^2 value from our baseline regression, which includes all observed variables as controls and the year, industry, and province fixed effects.

Next, we estimate the bounds of *CEOage*'s coefficient, $[\beta_{baseline}, \beta * (\min\{1.3 * R^2_{baseline}, 1\}, 1)]$, and check if the interval excludes zero or not. Row (2) presents the estimated bounds. We observe that the bounds exhibit very limited movement and do not encompass zero. This suggests that controlling for both observable and unobservable variables would not result in a significantly different conclusion compared to solely controlling for the observable variables in our baseline regressions.

Row (4) reports Oster's δ, which leads to *CEOage*'s coefficient being zero with the assumption of $R_{max}=1.3 * R^2_{baseline}$. Oster's δ indicates the degree of selection on unobservable variables relative to observable variables that would be required to entirely explain our results through omitted variable bias. Based on Oster's (2019) recommendation, we compare the δ value to 1 and observe that the absolute value of δ estimate is 18.7507. It is highly improbable that unobservable variables are about 18 times as influential as all the observable variables included in our baseline regression. Overall, the results from Oster's test indicate that the estimated effect of CEO age on corporate digital transformation is unlikely to be primarily driven by omitted variable bias.

4.3.2 Propensity score matching

To account for the observed differences in covariates across firms, we employ a PSM approach. Specifically, we divide our sample into a treatment group including firms with young CEOs group and a control group including firms with old CEOs, based on the median value of *CEOage*. Following Dehejia and Wahba (2002), we perform one-to-one nearest-neighbor matching without replacement and impose a caliper width of 0.0001. The matching process is based on all control variables specified in our baseline regressions.

Column (1) of Panel A of Table 4 reports the results of the pre-match propensity score regression. The estimated coefficients of *Gender*, *Tenure*, *Asset*, *Q*, *Leverage*, *Firmage*, *Big4*, *Top1*, *and Dual* are statistically significant. To verify that firm-year observations in the treatment and control groups have similar observed characteristics, we first re-estimate the match propensity score regression for the post-match sample and present the results in column (2) of Panel A. All the estimated coefficients are statistically insignificant. Next, we directly compare the observed characteristics between the treatment and control groups. Panel B of Table 4 shows that the differences in the observed characteristics are all statistically insignificant. These two diagnostic tests assure us that the difference in digital transformation between the treatment and control groups is likely driven by CEO age, instead of the observable covariates.

Panel C of Table 4 presents the regression results using the propensity-score-matched sample. The coefficients of *CEOage* are negative and statistically significant, confirming that our main finding remains robust after accounting for observable heterogeneity.

4.3.3 Entropy balancing matching

As an alternative matching approach, we adopt EB matching which achieves a high degree of covariate balance and reduces model dependency in estimating causal effects (Hainmueller, 2012). Unlike our PSM approach, EB matching does not throw away unmatched observations from our sample.

Panel A of Table 5 presents the first, second, and third moments for observed covariates in the treatment and control groups. We find that the distributions of the covariates are similar between the treatment and control groups after our EB matching. Panel B of Table 5 presents the regression results in the EB-matched sample. Consistent with the results shown in Table 2, the coefficients of *CEOage* are negative and statistically significant at the 1% level. This indicates that after balancing the distributions of covariates between the treatment and control groups, the effect of CEO age on corporate digital transformation remains robust.

4.3.4 Instrumental variable method

In this section, we employ a two-stage least squares (2SLS) regression with an IV to mitigate the potential endogeneity concerns and enhance the robustness of our causal inference. Specifically, we use the annual average of CEO ages in an industry (*Indage*) as our IV. The age of a CEO appointed by a firm is usually associated with industry-specific characteristics, suggesting that *Indage* satisfies the IV's relevance condition. Furthermore, CEOs of firms within the same industry do not directly influence the decisions of other firms, confirming that *Indage* meets the IV's exogeneity condition.

Table 6 presents the results of the 2SLS regression. Column (1) shows that in the first-stage regression, the coefficient of *Indage* is positive and statistically significant, thereby confirming the relevance condition. The value of the F-statistic is 174.15 in the first-stage regression, surpassing the threshold of 10, indicating that our IV is not weak (Stock and Yogo, 2005). Column (2) reports the second-stage regression results. The coefficient of instrumented *CEOage* remains negative and statistically significant, reaffirming that our main finding remains robust after addressing the potential endogeneity.

4.3.5 Difference-in-differences estimator

To address potential reverse causality arising from the possibility that firms with a stronger emphasis on digital transformation tend to appoint younger CEOs, we conduct a DID regression utilizing CEO turnovers. Specifically, we define a CEO turnover year as the first year when a new CEO takes office. Our DID sample covers firm-year observations five years before and five years after CEO turnovers, including CEO turnover years. Our DID regression model is as follows:

$$DCG_{i,t} = \beta_0 + \beta_1 Old\_to\_young_i \times Turnover\_post_{i,t-1} + \beta_2 Old\_to\_young_i + \beta_3 Turnover\_post_{i,t-1} + \gamma' Controls_{i,t-1} + \mu_i + \theta_t + \varepsilon_{i,t} \quad (2)$$

where *Old_to_young*$_i$ is an indicator variable equal to one for firms transiting from older to younger CEOs and zero for those transiting from younger to older CEOs; and *Turnover_post*$_{i,t}$ is an indicator variable equal to one for firm-years after CEO turnovers and zero otherwise. Control variables are the same as those in our baseline regression Equation (1). μ_i stands for the firm fixed effects and θ_t refers to the year fixed effects.

Table 7 reports the results of regression Equation (2). Column (1) is based on all CEO turnovers over our sample period, while column (2) is based on CEO turnovers due to death and normal retirement reasons. Previous studies suggest that CEO turnovers due to death and normal retirement reasons tend to be more exogenous than those due to the other reasons (e.g., Bushman et al., 2010; Cao et al., 2017). Columns (1)-(2) show that the coefficients of *Turnover_post*$_{i,t}$× *Old_to_young*$_i$ are positive and statistically significant. This result indicates that compared to transitions from younger CEOs to older CEOs, there is a significant increase in digital transformation when firms shift from older CEOs to younger CEOs. Our DID finding confirms that young CEOs significantly promote corporate digital transformation.

4.3.6 High dimensional fixed effects

Gormley and Matsa (2014) argue that unobserved heterogeneity is usually common across a certain group of observations. In our baseline regression, we have controlled for the firm, industry, and province fixed effects. In this section, we adopt high-dimensional fixed effect models to control for time-varying heterogeneity across industries or time-varying heterogeneity across provinces.

Table 8 presents the results. In column (1), we control for the firm fixed effects and year×industry fixed effects. In column (2), we control for the firm fixed effects and year×province fixed effects. Consistent with our main finding presented in Table 2, the coefficients of *CEOage* are negative and statistically significant.

5. Supplementary tests

5.1 Mechanism tests

5.1.1 Reputation establishment

We begin by examining whether young CEOs tend to engage in corporate digital transformation to establish their reputation. Younger CEOs are motivated to build a strong reputation and showcase their superior abilities in the job market. They may achieve this by making decisions that attract greater external attention, such as implementing changes in corporate strategies (Serfling, 2014; Gillan et al., 2021). Corporate digital transformation, recognized as an effective strategy for achieving firm performance growth, garners extensive attention from society (Chen et al., 2023). Therefore, young CEOs might exhibit a predisposition towards adopting digital transformation initiatives.

CEOs operating in highly competitive industries often confront significant external pressure, which can further motivate them to establish a reputation (Fama, 1980; Agrawal et al., 2006; Aghion et al., 2013). If reputation establishment is indeed a mechanism through which young CEOs promote digital transformation, this effect should be more pronounced in highly competitive industries.

Following Fan and Xu (2023), we use the Herfindahl Index (*HHI*)[3] to measure the level of external industry competition. A higher *HHI* implies lower industry competition. We divide our samples into two sub-samples, one with firms in high-competition industries and the other with firms in low-competition industries, based on the sample median of *HHI*. We re-estimate our baseline regression in the two sub-samples. Panel A of Table 9 shows that the coefficient of *CEOage* is negative and statistically significant in the high-competition sub-sample, but statistically insignificant in the low-competition sub-sample. Based on the result of a seemingly unrelated regression (SUR), we observe a significant difference (Prob > chi2 = 0.058) in the coefficients of *CEOage* between these two sub-samples. Therefore, our evidence supports the notion that reputation establishment serves as a mechanism motivating young CEOs to actively engage in corporate digital transformation.

5.1.2 Tolerance for failure

We then conduct a mechanism test, focusing on CEOs' tolerance for failure. Digital transformation is a risky corporate strategy, requiring substantial investments of human and financial resources, while the outcomes remain uncertain (Mo and Liu, 2023). Compared with older CEOs, younger CEOs tend to exhibit greater tolerance for failure, which could make them more inclined to undertake risky digital transformation initiatives. We explore this mechanism by examining the influence of labor market pressures on CEOs' decision-making. If tolerance for failure plays a pivotal role in the negative relation between CEO age and digital transformation, we expect that the negative relation is more pronounced when CEOs encounter higher labor market pressures.

We adopt two variables to measure labor market pressures. Firstly, we consider the unemployment rate (*UR*) in the region where a firm operates. A higher value of *UR* implies greater labor market pressures faced by CEOs. Secondly, we use the local beta (*Local*), which assesses the degree to which a firm's stock returns align with those of other firms in the same city,[4] as a measure of labor market pressures (Pirinsky and Wang 2006, Kedia and Rajgopal 2009). A higher *Local* indicates more significant labor market pressures for CEOs.

We divide our sample into high-pressure and low-pressure sub-samples based on the sample median of *UR* and *Local*. Panel B of Table 9 reports the baseline regression results in two sub-samples. Columns (1)-(2) show that the coefficient of *CEOage* is negative and statistically significant in the high unemployment sub-sample, but statistically insignificant in the low unemployment sub-sample. Our SUR test result indicates that there is a significant difference (Prob > chi2 = 0.002) in the coefficients

[3] $HHI = \sum (X_i / X)^2$, where X_i represents the sales of firm *i* and *X* is the total sales of the firms in the same industry.

[4] *Local* is β_1 estimated using a time-series regression of monthly stock returns on the returns of the other stocks in the same city (excluding the focal stock), as well as the market returns. The regression model is: $R_t=\alpha_i+\beta_1*R_t^{local}+\beta_2*R_t^{market}+\mu_{i,t}$, where R_t is a firm's monthly returns, R_t^{local} is the monthly returns of other stocks in the same city as the focal stock, and R_t^{market} is the market returns.

of *CEOage* between the two sub-samples. Similarly, columns (3)-(4) show that the coefficient of *CEOage* is negative and statistically significant in the sub-sample characterized by high labor market pressure, while statistically insignificant in the low-pressure sub-sample. Again, our SUR test result indicates a significant difference (Prob > chi2 = 0.002) in the coefficients of *CEOage* between the two sub-samples. Collectively, our empirical results in this section suggest that young CEOs' tolerance for failure helps explain the negative relation between CEO age and corporate digital transformation.

5.1.3 Agency problem

The negative relation between CEO age and digital transformation may also be attributed to agency problems. Digital transformation is a long-term investment activity with potential future benefits. As CEOs get older, they may become entrenched in their positions, leading to agency problems (McClelland et al., 2012). For example, Dechow et al. (1991) show that firms with older CEOs are more likely to engage in earnings management. Consequently, older CEOs might be subject to managerial short-termism and be less likely to invest in digital transformation. Since strong corporate governance can constrain agency issues, we investigate whether the impact of CEO age on digital transformation exhibits any variations with respect to different levels of corporate governance.

We employ two variables to measure corporate governance. The first is the natural logarithm of one plus the number of analysts following a firm (*Analyst*). Higher analyst coverage helps to improve corporate governance (e.g., To et al., 2018; Lehmann, 2019) and alleviate agency problems (e.g., Chen et al., 2015; Yu, 2008). Secondly, following Gompers et al. (2003) and Zhang and Liao (2010), we use the governance index (*Gindex*) to gauge the quality of firms' corporate governance.[5] A higher *Gindex* indicates better corporate governance. Based on the sample median of *Analyst* and *Gindex*, we divided our sample into high-governance and low-governance sub-samples.

Panel C of Table 9 shows that the coefficients of *CEOage* are negative and statistically significant in the high- and low-governance sub-samples. The results based on our SUR tests suggest no significant difference in the coefficients of *CEOage* between these two sub-samples. These findings suggest that the agency problem is not a mechanism through which young CEOs are more inclined to pursue corporate digital transformation.

5.2 Further heterogeneity tests

5.2.1 SOEs vs. non-SOEs

[5] Following the method outlined by Gompers et al. (2003) and Zhang et al. (2010), we select 12 indicators from three key dimensions: shareholding structure and shareholders' equity, management governance, and directors, supervisors, and other governance. Next, we use a principal component analysis to construct *Gindex*. *Gindex* is the linear combination of the loading coefficients of the first principal component. The construction equation is as follows:

$Gindex$=-0.5469*$Top1$+0.4677*$Equity\_balance$+0.2014*$Meeting$+0.2307*$Shares1$-0.4910*$Shares2$+0.1294*$Dual$+0.2730*$Shares3$-0.0964*D_size+0.1013*$Id\_percentage$+0.1551*Num_d+0.1113*Num_s-0.0007*$Committee$

Top1 is the percentage of shares held by the largest shareholder. *Equity_balance* is the sum of shares held by the second largest shareholder to the fifth largest shareholder divided by *Top1*. *Meeting* is the number of annual shareholder meetings. *Shares1*, *Shares2*, and *Share3* represent the proportion of tradable shares, state-owned shares, and shares held by management, respectively. *Dual* is a dummy variable that equals 1 if a CEO is also the chairman and 0 otherwise. *D_size* is the number of boards of directors. *Id_percentage* is the proportion of independent directors on a firm's board. *Num_d* and *Num_s* represent the number of annual meetings of board of directors and the number of annual meetings of board of supervisors, respectively. *Committee* is the number of various board committees.

In the Chinese market, state-owned enterprises (SOEs) and non-state-owned enterprises (non-SOEs) exhibit disparities in terms of policy resources and managerial incentives, which subsequently affect CEOs' decision-making process (Wernerfelt, 1984; Barney et al., 2021). We examine the cross-sectional variation of the relation between CEO age and digital transformation with respect to Chinese firms' ownership structure.

We divide our sample into a sub-sample of SOEs and a sub-sample of non-SOEs. Then we re-estimate our baseline regression in the two subsamples and report the results in columns (1) and (2) of Table 10. We observe that the coefficients of *CEOage* are negative and statistically significant in the two sub-samples. Based on our SUR test, there is no statistically significant difference (Prob>chi2=0.651) in the coefficient of *CEOage* between these two sub-samples. When comparing SOEs with non-SOEs in China, non-SOEs usually encounter business environments that closely resemble those found in countries with market-oriented economies. Consequently, our result holds the potential to contribute valuable insights to the prevailing literature, which has predominantly concentrated on developed countries.

5.2.2 Financial constraints

Zhang et al. (2023) show that the ability of firms to undertake digital transformation often hinges on the presence of long-term and stable financial resources. We expect that the negative relation between CEO age and corporate digital transformation is more pronounced among firms with fewer financial constraints. Following Hadlock and Pierce (2010), we use the SA index[6] as a proxy for financial constraints. A higher SA index indicates a greater level of financial constraints.

We divide our sample into a high-constraints sub-sample and a low-constraints sub-sample based on the sample median of the SA index value. Then we re-estimate our baseline regression in these two subsamples and report the results in columns (3) and (4) of Table 10. The coefficient of *CEOage* is negative and statistically significant in the low-constrained sub-sample, but statistically insignificant in the high-constrained sub-sample. Our SUR test reveals a statistically significant difference (Prob>chi2=0.082) in the coefficients of *CEOage* between these two sub-samples. Compared with firms facing more financial constraints, the negative relation between CEO age and corporate digital transformation is more prominent in firms with fewer financial constraints.

6. Conclusion

This paper examines the empirical relation between CEO age and corporate digital transformation. Consistent with our hypothesis, we find that firms led by younger CEOs tend to be more proactive in pursuing corporate digital transformation initiatives. Our finding remains robust to a battery of identification tests. Further investigation shows that CEOs' motivation to establish a strong reputation and their tolerance for failure as a part of the digital transformation journey are the two underlying mechanisms that

[6] $SA=-0.737*Size+0.043*Size^2-0.040*Age$, where *Size* represents the natural logarithm of a firm's total assets and *Age* represents firm age.

drive the negative relation between CEO age and digital transformation. Our cross-sectional analysis also shows that the negative relation does not vary with firms' state ownership but is more pronounced for firms with fewer financial constraints.

Overall, our study sheds light on the importance of young CEOs in shaping corporate digital transformation strategies. CEO age serves as a valuable addition to the existing body of research on the influence of CEO characteristics on corporate strategies.

Appendix

Table A1

This table provides the definitions of the variables and corresponding data sources.

Variables	Definitions	Source
Dependent Variables		
DCG	The logarithm of 1 plus the frequency of occurrence of all digitalization-related keywords in the annual reports.	CSMAR
Independent Variables		
CEOage	The logarithm of firm's CEO's age.	CSMAR
Control Variables		
Gender	Equals 1 if the CEO is male, otherwise equals 0.	CSMAR
Tenure	the year that CEO has been working in the firm.	CSMAR
Salary	The logarithm of firm's CEO's salary.	CSMAR
Share	The logarithm value of CEO's shares.	CSMAR
Asset	The logarithm of total asset.	CSMAR
Q	The market value of equity plus book value of debt scaled by book value of assets.	CSMAR
ROE	Rate of return on equity.	CSMAR
Leverage	Total liabilities/total assets	CSMAR
Sales	The logarithm of total sales.	CSMAR
Firmage	The logarithm of years since the firm was founded.	CSMAR
Big4	Equals 1 if the firm was audited by PWC, KPMG, EY or Deloitte, otherwise equals 0.	CSMAR
Top1	The percentage of shares held by the largest shareholder out of the total shares.	CSMAR
Dual	Equals 1 if the CEO is also the chairman, otherwise equals 0.	CSMAR
Indage	The annual average ages of CEOs in the same industry.	CSMAR
Old_to_young	An indicator variable equal to 1 for firms with turnovers from older to younger CEOs and 0 for those with transitions from younger to older CEOs.	CSMAR
Turnover_post	An indicator variable equal to 1 for firm-years after CEO turnovers, and 0 otherwise.	CSMAR
HHI	$HHI=\Sigma(X_i/X)^2$, where X_i represents the sales of firm I and X is the total sales of the firms in the same industry.	CSMAR
UR	The unemployment rate of a city where the firm is headquartered.	CSMAR
Local	*Local* is β_1 estimated using a time-series regression of monthly stock returns on the returns of the other stocks in the same city (excluding the focal stock), as well as the market returns: $R_t=\alpha_i+\beta_1 * R_t^{local}+\beta_2 * R_t^{market}+\mu_{i,t}$, where R_t is a firm's monthly returns. A higher *Local* indicates more significant labor market pressures for CEOs (Pirinsky and Wang, 2006; Kedia and Rajgopal, 2009).	CSMAR
Analyst	The natural logarithm of 1 plus the number of analysts following a firm.	CSMAR
Gindex	A corporate governance index composed of 12 indicators following Gompers et al. (2003) and Zhang and Liao (2010). The construction equation is as follows:	CSMAR

	Gindex=0.5469**Top1*+0.4677**Equity_balance*+ 0.2014**Meeting*+0.2307**Shares1*-0.4910**Shares2*+ 0.1294**Dual*+0.2730**Shares3*-0.0964**D_size*+ 0.1013* *Id_percentage* +0.1551**Num_d*+0.1113**Num_s*- 0.0007**Committee* where *Top1* is the percentage of shares held by the largest shareholder; *Equity_balance* is the sum of shares held by the second largest shareholder to the fifth largest shareholder divided by *Top1*; *Meeting* is the number of annual shareholders' meetings held by a firm; *Shares1*, *Shares2*, and *Shares3* represent the proportion of tradable shares, state-owned shares, and shares held by management, respectively; *Dual* is an indicator variable equal to 1 if a CEO is also the board chairman, and 0 otherwise; *D_size* is the number of board directors; *Id_percentage* is the ratio of the number of independent directors to the total number of board directors; *Num_d* and *Num_s* represent the number of board directors and the number of board supervisors, respectively; and *Committee* is the number of various committees established by a firm. A higher *Gindex* indicates better corporate governance.	
SA	*SA* is the financial constraint index following Hadlock and Pierce (2010). $SA=-0.737*Size+0.043*Size^2-0.040*Age$, where *Size* represents the natural logarithm of a firm's total assets and *Age* represents the number of years since a firm is founded. A larger value of *SA* implies a higher level of financial constraints.	CSMAR

Table A2

This table provides the keyword lexicon of corporate digital transformation. We compile digital transformation keywords from the existing literature and official government website. The greater number of keywords related to digital transformation in a firm's annual report, the more attention the firm has devoted to digital transformation.

Technology category	Keywords
Artificial intelligence	Intelligence, Automation, 5G, Wisdom construction, Wisdom business, Image recognition, Face recognition, Natural language processing, 3D technology, AI, Robot, Machine learning, etc.
Big data	Big data, Data Integration, Data visualization, Data information, Data management, Data asset, Virtual reality, etc.
Block chain	Block chain, Digital currency, Cryptocurrency, Distributed computing, Privacy technology, Smart contract, etc.
Cloud computing	Cloud computing, Image computing, Cognitive computing, Memory computing, Cloud Service, Internet of things (IOT), Cyber-physical system, etc.
Application of Digital Technology	Digital technology, Digitization, Digital marketing, Digital operations, Digital economy, Digital trade, Digital system, Digital supply chain, Digital finance, Fin-tech, Internet finance, Information technology, Information integration, Information communication, E-commerce, Mobile payment, Third party payment, Electronic technique, Electronic technology, Cross border E-commerce, E-commerce platform, Online and offline, O2O, B2B, C2C, P2P, C2B, B2C, etc.

Reference

[1] Aghion, P., Van Reenen, J., & Zingales, L. (2013). Innovation and institutional ownership. *American economic review*, *103*(1), 277-304.

[2] Agrawal, A., Knoeber, C. R., & Tsoulouhas, T. (2006). Are outsiders handicapped in CEO successions?. *Journal of Corporate Finance*, *12*(3), 619-644.

[3] Allgood, S., & Farrell, K. A. (2000). The effect of CEO tenure on the relation between firm performance and turnover. *Journal of financial research*, *23*(3), 373-390.

[4] Andreou, P. C., Louca, C., & Petrou, A. P. (2017). CEO age and stock price crash risk. *Review of Finance*, *21*(3), 1287-1325.

[5] Barney, J. B., Ketchen Jr, D. J., & Wright, M. (2021). Resource-based theory and the value creation framework. *Journal of Management*, *47*(7), 1936-1955.

[6] Bertrand, M., & Schoar, A. (2003). Managing with style: The effect of managers on firm policies. *The Quarterly journal of economics*, *118*(4), 1169-1208.

[7] Borghesi, R., Houston, J. F., & Naranjo, A. (2014). Corporate socially responsible investments: CEO altruism, reputation, and shareholder interests. *Journal of Corporate Finance*, *26*, 164-181.

[8] Bushman, R., Dai, Z., & Wang, X. (2010). Risk and CEO turnover. *Journal of Financial Economics*, *96*(3), 381-398.

[9] Cao, X., Pan, X., Qian, M., & Tian, G. G. (2017). Political capital and CEO entrenchment: Evidence from CEO turnover in Chinese non-SOEs. *Journal of Corporate Finance*, *42*, 1-14.

[10] Chen, S., Ni, S. X., & Zhang, F. (2018). CEO retirement, corporate governance and conditional accounting conservatism. *European Accounting Review*, *27*(3), 437-465.

[11] Chen, T., Harford, J., & Lin, C. (2015). Do analysts matter for governance? Evidence from natural experiments. *Journal of Financial Economics*, *115*(2), 383-410.

[12] Chen, W., & Srinivasan, S. (2023). Going digital: Implications for firm value and performance. *Review of Accounting Studies*, 1-47.

[13] Chen, Z., Xiao, Y., & Jiang, K. (2023). The impact of tax reform on firm" digitalization in China. *Technological Forecasting and Social Change*, *187*, 122196.

[14] Child, J. 1974. Managerial and organizational factors associated with company performance part I. *Journal of Management Studies*, *11*(3): 175-189.

[15] Cho, S. Y., & Kim, S. K. (2017). Horizon problem and firm innovation: The influence of CEO career horizon, exploitation and exploration on breakthrough innovations. *Research Policy*, *46*(10), 1801-1809.

[16] Cronqvist, H., Makhija, A. K., & Yonker, S. E. (2012). Behavioral consistency in corporate finance: CEO personal and corporate leverage. *Journal of financial economics*, *103*(1), 20-40.

[17] Dechow, P. M., & Sloan, R. G. (1991). Executive incentives and the horizon problem: An empirical investigation. *Journal of accounting and Economics*, *14*(1),

51-89.
[18] Dehejia, R. H., & Wahba, S. (2002). Propensity score-matching methods for nonexperimental causal studies. *Review of Economics and statistics*, *84*(1), 151-161.
[19] Dou, B., Guo, S., Chang, X., & Wang, Y. (2023). Corporate digital transformation and labor structure upgrading. *International Review of Financial Analysis*, *90*, 102904.
[20] Duan, C., & Sandhu, K. (2023). Advancement of sharing economy for digital innovation in emerging countries. *Economics Letters*, *233*, 111364.
[21] Fama, E. F. (1980). Agency problems and the theory of the firm. *Journal of political economy*, *88*(2), 288-307.
[22] Fan, J., & Xu, M. (2023). The power of competition: Unveiling Chin''s digital transformation through product market dynamics. *Economics Letters*, 111479.
[23] Gao, H. (2010). Market misvaluation, managerial horizon, and acquisitions. *Financial Management*, *39*(2), 833-850.
[24] Genz, S., & Schnabel, C. (2023). Digitalization is not gender-neutral. *Economics Letters*, *230*, 111256.
[25] Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, *66*, 101889.
[26] Goldfarb, A., & Tucker, C. (2019). Digital economics. *Journal of economic literature*, *57*(1), 3-43.
[27] Gompers, P., Ishii, J., & Metrick, A. (2003). Corporate governance and equity prices. *The quarterly journal of economics*, *118*(1), 107-156.
[28] Gormley, T. A., & Matsa, D. A. (2014). Common errors: How to (and not to) control for unobserved heterogeneity. *The Review of Financial Studies*, 27(2), 617-661.
[29] Hadlock, C. J., & Pierce, J. R. (2010). New evidence on measuring financial constraints: Moving beyond the KZ index. *The review of financial studies*, *23*(5), 1909-1940.
[30] Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. *Political analysis*, *20*(1), 25-46.
[31] Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of management review*, *9*(2), 193-206.
[32] Hossain, M. N., Rabarison, M. K., Ater, B., & Sobngwi, C. K. (2023). CEO marital status and dividend policy. *Journal of Corporate Finance*, *78*, 102342.
[33] Huang, H. W., Rose-Green, E., & Lee, C. C. (2012). CEO age and financial reporting quality. *Accounting horizons*, *26*(4), 725-740.
[34] Jenter, D., & Lewellen, K. (2015). CEO preferences and acquisitions. *The Journal of Finance*, *70*(6), 2813-2852.
[35] Kalyta, P. (2009). Accounting discretion, horizon problem, and CEO retirement benefits. *The Accounting Review*, *84*(5), 1553-1573.
[36] Karimi, J., & Walter, Z. (2015). The role of dynamic capabilities in responding to

digital disruption: A factor-based study of the newspaper industry. *Journal of Management Information Systems*, *32*(1), 39-81.
[37] Kedia, S., & Rajgopal, S. (2009). Neighborhood matters: The impact of location on broad based stock option plans. *Journal of Financial economics*, *92*(1), 109-127.
[38] Lehmann, N. (2019). Do corporate governance analysts matter? Evidence from the expansion of governance analyst coverage. *Journal of Accounting Research*, *57*(3), 721-761.
[39] Li, X., Low, A., & Makhija, A. K. (2017). Career concerns and the busy life of the young CEO. *Journal of Corporate Finance*, *47*, 88-109.
[40] McClelland, P. L., Barker III, V. L., & Oh, W. Y. (2012). CEO career horizon and tenure: Future performance implications under different contingencies. *Journal of Business Research*, *65*(9), 1387-1393.
[41] Mo, Y., & Liu, X. (2023). Climate policy uncertainty and digital transformation of enterprise–Evidence from China. *Economics Letters*, 111377.
[42] Oh, W. Y., Chang, Y. K., & Cheng, Z. (2016). When CEO career horizon problems matter for corporate social responsibility: The moderating roles of industry-level discretion and blockholder ownership. *Journal of Business Ethics*, *133*, 279-291.
[43] Oster, E. (2019). Unobservable selection and coefficient stability: Theory and evidence. *Journal of Business & Economic Statistics*, *37*(2), 187-204.
[44] Pirinsky, C., & Wang, Q. (2006). Does corporate headquarters location matter for stock returns? *The Journal of Finance*, *61*(4), 1991-2015.
[45] Ramaswamy, V., & Ozcan, K. (2016). Brand value co-creation in a digitalized world: An integrative framework and research implications. *International Journal of Research in Marketing*, *33*(1), 93-106.
[46] Reitenga, A. L., & Tearney, M. G. (2003). Mandatory CEO retirements, discretionary accruals, and corporate governance mechanisms. *Journal of Accounting, Auditing & Finance*, *18*(2), 255-280.
[47] Serfling, M. A. (2014). CEO age and the riskiness of corporate policies. *Journal of corporate finance*, *25*, 251-273.
[48] Stock, J. H., & Yogo, M. (2002). Testing for weak instruments in linear IV regression.
[49] Teece, D. J. (2018). Profiting from innovation in the digital economy: Enabling technologies, standards, and licensing models in the wireless world. *Research policy*, *47*(8), 1367-1387.
[50] To, T. Y., Navone, M., & Wu, E. (2018). Analyst coverage and the quality of corporate investment decisions. *Journal of Corporate Finance*, *51*, 164-181.
[51] Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of business research*, *122*, 889-901.
[52] Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The journal of strategic information systems*, *28*(2), 118-144.
[53] Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic management*

journal, *5*(2), 171-180.

[54] Yim, S. (2013). The acquisitiveness of youth: CEO age and acquisition behavior. *Journal of financial economics*, *108*(1), 250-273.

[55] Yu, F. F. (2008). Analyst coverage and earnings management. *Journal of financial economics*, *88*(2), 245-271.

[56] Zhang, X., & Liao, L. (2010). Split Share Structure Reform, Voluntary Information Disclosure and Corporate Governance. *Economic Research*, *45*(4), 28-39 + 53.

[57] Zhang, Y., Ge, M., Yang, J., Liu, C., & Chen, X. (2023). Controlling shareholder'' equity pledge, digital finance, and corporate digital transformation. *International Review of Financial Analysis*, *90*, 102853.

[58] Zhou, Z., & Li, Z. (2023). Corporate digital transformation and trade credit financing. *Journal of Business Research*, *160*, 113793.

Tables

Table 1. Summary statistics

This table presents summary statistics of all variables used in our empirical analysis. The data are all collected from the China Stock Market & Accounting Research (CSMAR) database. The number of observations, mean, standard deviation, minimum, median, and maximum of each variable are successively reported from left to right. The detailed definitions of all variables are in Appendix Table A1.

Variables	Obs.	Mean	S.D.	Min.	Median	Max.
Dependent Variables						
DCG	26, 402	1.161	1.378	0.000	0.693	6.301
Independent Variables						
CEOage	26, 402	3.889	0.142	3.258	3.892	4.394
Control Variables						
Gender	26, 402	0.931	0.253	0.000	1.000	1.000
Tenure	26, 402	3.706	0.415	0.693	3.747	4.900
Salary	26, 402	12.980	2.061	0.000	13.240	17.160
Share	26, 402	8.302	7.960	0.000	10.440	21.460
Asset	26, 402	21.990	1.278	19.260	21.810	26.080
Q	26, 402	2.097	1.390	0.866	1.660	9.584
ROE	26, 402	0.054	0.150	-0.860	0.070	0.360
Leverage	26, 402	0.417	0.208	0.051	0.405	0.990
Sales	26, 402	21.300	1.459	17.430	21.150	25.500
Firmage	26, 402	2.749	0.425	0.000	2.833	3.989
Big4	26, 402	0.055	0.228	0.000	0.000	1.000
Top1	26, 402	0.346	0.150	0.024	0.324	0.900
Dual	26, 402	0.290	0.454	0.000	0.000	1.000

Table 2. CEO age and corporate digital transformation

This table reports the results of OLS regressions examining the relation between CEO age and corporate digital transformation. The sample covers firm observations with non-missing values for all variables from 2007 to 2022. The coefficients of the fixed effects are suppressed for brevity in the respective columns. The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)
	DCG_t	DCG_t	DCG_t	DCG_t
$CEOage_{t-1}$	-0.1787***	-0.6266***	-0.4332***	-0.2382***
	(-2.990)	(-10.354)	(-9.556)	(-4.774)
$Gender_{t-1}$		-0.1211***	-0.1008***	-0.0062
		(-3.717)	(-4.165)	(-0.218)
$Tenure_{t-1}$		0.0480**	0.0632***	0.0081
		(2.294)	(3.978)	-0.504
$Salary_{t-1}$		0.0207***	0.0019	-0.0033
		(5.056)	(0.606)	(-1.223)
$Share_{t-1}$		0.0256***	0.0086***	0.0054***
		(21.950)	(9.485)	(4.966)
$Assset_{t-1}$		0.0573***	0.0379***	0.1241***
		(3.959)	(2.976)	(7.197)
Q_{t-1}		0.0670***	0.0276***	0.0374***
		(10.345)	(5.299)	(7.011)
ROE_{t-1}		-0.3878***	-0.0806*	0.0800**
		(-6.577)	(-1.812)	(2.123)
$Leverage_{t-1}$		-0.8102***	-0.2313***	-0.0780*
		(-16.800)	(-5.985)	(-1.645)
$Sales_{t-1}$		0.1168***	0.1249***	0.0683***
		(9.433)	(11.400)	(4.9140)
$Firmage_{t-1}$		0.1364***	-0.0494***	0.0231
		(6.620)	(-2.754)	-0.506
$Big4_{t-1}$		-0.0975**	-0.0914***	0.0584
		(-2.525)	(-3.112)	-1.328
$Top1_{t-1}$		-0.5534***	-0.1624***	-0.1534**
		(-9.420)	(-3.617)	(-1.974)
$Dual_{t-1}$		0.1913***	0.0832***	0.0131
		(9.653)	(5.608)	(0.773)
Constant	1.8556***	-0.7106***	-1.5156***	-2.8226***
	(7.978)	(-2.594)	(-6.238)	(-9.014)
Year fixed effects	No	No	Yes	Yes
Industry fixed effects	No	No	Yes	No
Province fixed effects	No	No	Yes	No
Firm fixed effects	No	No	No	Yes
Observations	26,402	26,402	26,402	26,402
Adjsuted-R^2	0.0003	0.067	0.502	0.424

Table 3. Oster's test

This table reports the results of Oster's (2019) test to evaluate the robustness of our baseline regressions (columns (3) in Table 2) to omitted variable bias. δ is assumed to be one so that the observed and unobserved factors have an equally important effect on the coefficient of *CEOage* (Controlled effect). R_{max} is the upper bound of R^2 which would result if all unobserved factors were included in the regression. In line with Oster (2019), we define R_{max} as 1.3 times R^2 from our baseline regressions that control for all observed factors. The Oster bounds are estimated using Stata code psacalc. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)
	DCG_t
(1) Controlled effect	-0.4332***
	(-9.556)
(2) Oster bounds (δ=1, $R_{\max}$=1.3*R^2)	(-0.4621, -0.4332)
(3) CEO age effect excludes zero	Yes
(4) Oster's delta ($R_{\max}$=1.3*R^2)	-18.7507
Baseline controls	Yes
Year fixed effects	Yes
Industry fixed effects	Yes
Province fixed effects	Yes

Table 4. Propensity score matching

This table reports the results of a propensity score matching (PSM) approach. To balance the observed differences in covariates between firms with young and old CEOs, we divide our sample into treatment and control groups, based on the median of *CEOage*. We match firms in the treatment and control groups based on the control variables in regression Equation (1). We adopt one-to-one nearest neighbor matching without replacement and require a caliper width of 0.0001. Panel A reports the parameter estimates from the logit model used to estimate the propensity scores. Panel B reports diagnostic statistics for the differences in covariates using t-tests. Panel C reports the regression results based on the propensity score matched sample. The detailed definitions of all variables are in Appendix Table A1. The t-values and z-values reported in parentheses are based on robust standard errors. ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Pre-match regression and post-match diagnostic regression

	(1) Pre-match	(2) Post-match
$Gender_{t-1}$	0.0542*	0.0143
	(1.687)	(0.367)
$Tenure_{t-1}$	0.2901***	0.0019
	(13.666)	(0.071)
$Salary_{t-1}$	0.0029	(0.0017)
	(0.710)	(-0.328)
$Share_{t-1}$	0.0019	0.0006
	(1.571)	(0.430)
$Assset_{t-1}$	0.0713***	-0.0186
	(4.182)	(-0.885)
Q_{t-1}	0.0123*	-0.0035
	(1.761)	(-0.403)
ROE_{t-1}	0.0482	0.0319
	(0.813)	(0.443)
$Leverage_{t-1}$	-0.1119**	-0.0030
	(-2.174)	(-0.048)
$Sales_{t-1}$	0.0102	0.0052
	(0.698)	(0.291)
$Firmage_{t-1}$	0.1878***	0.0284
	(7.747)	(0.940)
$Big4_{t-1}$	0.1274***	-0.0174
	(3.245)	(-0.359)
$Top1_{t-1}$	0.3289***	0.0196
	(5.491)	(0.266)
$Dual_{t-1}$	0.5018***	-0.0235
	(25.677)	(-0.960)
Constant	-3.6009***	-0.0494
	(-14.263)	(-0.157)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
Province fixed effects	Yes	Yes
Observations	26,402	16,356
Pesudo R^2	0.088	0.002

Panel B. Diagnostics statistics – differences in firm characteristics

	Pre-match				Post-match			
	(1) Control (N=13,168)	(2) Treatment (N=13,234)	(3) Diff.	(4) T-stat.	(5) Control (N= 8,178)	(6) Treatment (N= 8,178)	(7) Diff.	(8) T-stat.
$Gender_{t-1}$	0.9267	0.9362	-0.0095***	-3.06	0.9271	0.9292	-0.0021	-0.51
$Tenure_{t-1}$	3.6494	3.7625	-0.1131***	-22.38	3.7096	3.7125	-0.0029	-0.46
$Salary_{t-1}$	12.9110	13.0492	-0.1382***	-5.45	13.0178	13.0153	0.0025	0.08
$Share_{t-1}$	7.8314	8.7697	-0.9383***	-9.59	8.2384	8.3117	-0.0733	-0.59
$Assset_{t-1}$	21.8410	22.1394	-0.2984***	-19.10	21.9858	21.9695	0.0163	0.84
Q_{t-1}	2.1061	2.0884	0.0177	1.03	2.1072	2.1079	-0.0007	-0.03
ROE_{t-1}	0.0514	0.0564	-0.0050**	-2.71	0.0509	0.0522	-0.0014	-0.58
$Leverage_{t-1}$	0.4161	0.4173	-0.0012	-0.48	0.4182	0.4158	0.0024	0.73
$Sales_{t-1}$	21.1520	21.4430	-0.2910***	-16.28	21.3015	21.2860	0.0155	0.69
$Firmage_{t-1}$	2.6924	2.8059	-0.1135***	-21.89	2.7597	2.7665	-0.0067	-1.06
$Big4_{t-1}$	0.0447	0.0658	-0.0212***	-7.53	0.0544	0.0517	0.0027	0.77
$Top1_{t-1}$	0.3423	0.3505	-0.0083***	-4.47	0.3427	0.3431	-0.0004	-0.19
$Dual_{t-1}$	0.2250	0.3539	-0.1288***	-23.31	0.2759	0.2728	0.0031	0.44

Panel C. Propensity score matching estimators

	(1)	(2)
	DCG_t	***DCG_t***
$CEOage_{t-1}$	-0.3301***	-0.2320***
	(-5.726)	(-3.680)
$Gender_{t-1}$	-0.0328	0.0130
	(-1.007)	(0.360)
$Tenure_{t-1}$	0.0448**	0.0237
	(2.213)	(1.088)
$Salary_{t-1}$	-0.0011	-0.0014
	(-0.295)	(-0.368)
$Share_{t-1}$	0.0063***	0.0053***
	(5.072)	(3.749)
$Assset_{t-1}$	0.0539***	0.1275***
	(2.814)	(5.512)
Q_{t-1}	0.0311***	0.0389***
	(4.651)	(5.352)
ROE_{t-1}	0.0465	0.0971**
	(0.972)	(1.988)
$Leverage_{t-1}$	-0.1211**	-0.0848
	(-2.168)	(-1.314)
$Sales_{t-1}$	0.1027***	0.0723***
	(6.434)	(3.907)
$Firmage_{t-1}$	-0.1097***	-0.1507**
	(-2.959)	(-2.194)
$Big4_{t-1}$	-0.0303	0.0386
	(-0.622)	(0.628)
$Top1_{t-1}$	-0.2435***	-0.2048**
	(-3.180)	(-1.980)
$Dual_{t-1}$	0.0593***	0.0380*
	(2.970)	(1.714)
Constant	-1.6932***	-2.6855***
	(-4.512)	(-6.291)
Firm fixed effects	No	Yes
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	No
Province fixed effects	Yes	No
Observations	16,356	16,356
Adjusted-R^2	0.414	0.423

Table 5. Entropy balancing matching

This table reports the results of an entropy balancing (EB) matching approach. To balance the observed differences in covariates between firms with young and old CEOs, we divide our sample into treatment and control groups, based on the median of *CEOage*. We reweight the observations in the control group so that the mean, variance, and skewness of the covariates are the same between the treatment and control groups. Panel A reports the matching efficiency of EB matching. Panel B reports the regression results based on the EB sample. The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Covariate balance

	Before matching						**After matching**		
	Treatment			**Control**			**Control**		
	Mean	**Variance**	**Skewness**	**Mean**	**Variance**	**Skewness**	**Mean**	**Variance**	**Skewness**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Gender	0.936	0.060	-3.550	0.927	0.068	-3.273	0.936	0.060	-3.550
Tenure	3.761	0.164	-0.810	3.642	0.173	-0.908	3.761	0.164	-0.810
Salary	13.060	4.695	-5.020	12.890	3.710	-5.266	13.060	4.695	-5.020
Share	8.810	64.560	-0.060	7.709	61.330	0.131	8.810	64.560	-0.060
Asset	22.110	1.760	0.771	21.850	1.449	0.734	22.110	1.760	0.771
Q	2.093	1.986	2.858	2.102	1.868	2.893	2.093	1.986	2.858
ROE	0.056	0.021	-3.612	0.052	0.024	-3.517	0.056	0.021	-3.612
Leverage	0.418	0.042	0.272	0.416	0.045	0.283	0.418	0.042	0.272
Sales	21.420	2.223	0.488	21.160	1.985	0.398	21.420	2.223	0.488
Firmage	2.803	0.151	-1.280	2.686	0.208	-1.299	2.803	0.151	-1.280
Big4	0.064	0.060	3.564	0.045	0.043	4.383	0.064	0.060	3.564
Top1	0.348	0.023	0.534	0.345	0.022	0.560	0.348	0.023	0.534
Dual	0.355	0.229	0.608	0.214	0.168	1.396	0.355	0.229	0.608

Panel B: Entropy balancing matching estimators

	(1)	(2)
	DCG_t	***DCG_t***
$CEOage_{t-1}$	-0.1203***	-0.1177***
	(-6.204)	(-8.496)
$Gender_{t-1}$	-0.0865**	-0.0816***
	(-2.356)	(-2.916)
$Tenure_{t-1}$	0.0093	0.0627***
	(0.388)	(3.529)
$Salary_{t-1}$	0.0166***	0.0017
	(3.929)	(0.578)
$Share_{t-1}$	0.0250***	0.0094***
	(18.564)	(8.936)
$Assset_{t-1}$	0.0362**	0.0334**
	(2.215)	(2.284)
Q_{t-1}	0.0595***	0.0260***
	(6.939)	(4.014)
ROE_{t-1}	-0.4333***	-0.1499***
	(-6.031)	(-2.880)
$Leverage_{t-1}$	-0.7541***	-0.2233***
	(-13.744)	(-5.043)
$Sales_{t-1}$	0.1324***	0.1316***
	(9.736)	(10.304)
$Firmage_{t-1}$	0.0480**	-0.0686***
	(2.039)	(-3.227)
$Big4_{t-1}$	-0.1169***	-0.0720**
	(-2.839)	(-2.422)
$Top1_{t-1}$	-0.5344***	-0.1242**
	(-7.634)	(-2.474)
$Dual_{t-1}$	0.1895***	0.0914***
	(7.925)	(5.392)
Constant	-2.5333***	-2.5333***
	(-10.141)	(-10.141)
Year fixed effects	No	Yes
Firm fixed effects	No	Yes
Observations	26,402	26,402
Adjusted-R^2	0.062	0.504

Table 6. Instrumental variable method

This table reports the results of a two-stage least squares regression with an instrumental variable (IV). The IV is the annual average of CEO ages in an industry (*Indage*). The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	First stage	**Second stage**
	(1)	**(2)**
	$CEOage_{t-1}$	DCG_t
Instrumented $CEOage_{t-1}$		-1.1706***
		(-3.747)
$Indage_{t-1}$	0.7151***	
	(23.941)	
$Gender_{t-1}$	0.0109***	0.005
	(2.983)	(0.175)
$Tenure_{t-1}$	0.0401***	0.0480**
	(19.415)	(2.295)
$Salary_{t-1}$	0.0006	-0.0028
	(1.593)	(-1.019)
$Share_{t-1}$	0.0025***	0.0078***
	(17.917)	(5.770)
$Assset_{t-1}$	0.0000	0.1229***
	(-0.001)	(7.068)
Q_{t-1}	-0.0002	0.0374***
	(-0.264)	(6.967)
ROE_{t-1}	-0.0015	0.0798**
	(-0.304)	(2.101)
$Leverage_{t-1}$	0.0046	-0.0734
	(0.754)	(-1.535)
$Sales_{t-1}$	0.0087***	0.0780***
	(4.870)	(5.431)
$Firmage_{t-1}$	0.0220***	0.0449
	(3.741)	(0.965)
$Big4_{t-1}$	0.0024	0.0592
	(0.418)	(1.335)
$Top1_{t-1}$	0.0658***	-0.0866
	(6.571)	(-1.065)
$Dual_{t-1}$	0.0741***	0.0825***
	(34.780)	(2.885)
Constant	0.6746	0.3152
	(6.090)	(0.290)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	26,402	26,402
Adjusted-R^2	0.170	0.416
F-statistic	174.15	

Table 7. Difference-in-differences estimators

This table reports the results of a difference-in-differences (DID) regression. The sample covers firm-year observations five years before and five years after CEO turnovers, including CEO turnover years. $Old\_to\_young_i$ is an indicator variable equal to one for firms with turnovers from older to younger CEOs and zero for those transiting from younger to older CEOs. $Turnover\_post_{i,t}$ is an indicator variable equal to one for firm-years after CEO turnovers and zero otherwise. We include all CEO turnovers in column (1) and CEO turnovers due to death and normal retirement reasons in column (2). The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ∗∗∗, ∗∗, and ∗ denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1) DCG_t	**(2)** DCG_t
$Turnover\_pos_{i,t} \times Old\_to\_young_i$	0.0702** (2.185)	0.0824*** (2.645)
$Old\_to\_young_{t-1}$	-0.0708** (-2.420)	-0.0364 (-1.355)
$Turnover\_post_{t-1}$	-0.0049 (-0.160)	-0.0413 (-1.529)
$Gender_{t-1}$	0.0298 (0.963)	0.0328 (0.915)
$Tenure_{t-1}$	-0.0063 (-0.322)	-0.0304 (-1.225)
$Salary_{t-1}$	-0.0028 (-0.965)	-0.0037 (-1.099)
$Share_{t-1}$	0.0044*** (3.585)	0.0041*** (2.840)
$Assset_{t-1}$	0.1327*** (6.527)	0.1008*** (3.904)
Q_{t-1}	0.0325*** (5.080)	0.0262*** (3.210)
ROE_{t-1}	0.0681 (1.575)	0.0307 (0.582)
$Leverage_{t-1}$	-0.0503 (-0.890)	-0.044 (-0.613)
$Sales_{t-1}$	0.0600*** (3.724)	0.0570*** (2.826)
$Firmage_{t-1}$	0.0114 (0.198)	-0.0373 (-0.492)
$Big4_{t-1}$	0.0793 (1.533)	0.0609 (0.938)
$Top1_{t-1}$	-0.1575* (-1.738)	(0.0690) (-0.608)
$Dual_{t-1}$	0.0077 (0.407)	0.0140 (0.627)
Constant	-3.6587*** (-11.354)	-2.8434*** (-6.873)
Firm fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Observations	18,746	12,509
Adjusted-R^2	0.407	0.386

Table 8. High dimensional fixed effect models

This table reports the results of high dimensional fixed effect models. In column (1), we control for the firm fixed effects and year×industry fixed effects. In column (2), we control for the firm fixed effects and year×province fixed effects. The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)
	DCG_t	DCG_t
$CEOage_{t-1}$	-0.1595***	-0.2274***
	(-3.411)	(-4.556)
Constant	-1.9031***	-2.2270***
	(-5.975)	(-6.673)
$Controls_{t-1}$	Yes	Yes
Firm fixed effects	Yes	Yes
Year×industry fixed effects	Yes	No
Year×province fixed effects	No	Yes
Observations	26,402	26,402
Adjsuted-R^2	0.797	0.755

Table 9. Mechanism Tests

This table reports the regression results of our three mechanism tests. Panel A focuses on reputation establishment, in which firms in high(low)-competition sub-sample have *HHI* below(above) its sample median. Panel B focuses on tolerance for failure, in which firms in high(low)-pressure sub-samples have UR or *Local* above(below) its sample median. Panel C focuses on corporate governance, in which firms in high(low)-governance sub-samples have *Analyst* or *Gindex* above(below) its sample median. The statistical significance of the differences in the estimated coefficients of *CEOage* between two sub-samples is examined using seemingly unrelated tests. The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Reputation establishment

	High-competition	**Low-competition**
	(1)	**(2)**
$CEOage_{t-1}$	-0.3558***	-0.0416
	(-4.686)	(-0.533)
Constant	-2.6573***	-4.1968***
	(-5.483)	(-8.441)
$Controls_{t-1}$	Yes	Yes
Year fixed effects	Yes	Yes
Firm fixed Effects	Yes	Yes
Observations	14,214	12,188
Adjusted-R^2	0.445	0.406
Prob>chi2	0.058	

Panel B. Tolerance for failure

	High-pressure	**Low-pressure**	**High-pressure**	**Low-pressure**
	Proxy= UR		*Proxy= Local*	
	(1)	**(2)**	**(3)**	**(4)**
$CEOage_{t-1}$	-0.3549***	-0.0068	-0.3167***	-0.1095
	(-5.827)	(-0.078)	(-4.218)	(-1.484)
Constant	-2.2890***	-3.6258***	-2.3539***	-3.1383***
	(-6.122)	(-5.812)	(-5.098)	(-6.559)
$Controls_{t-1}$	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	12,673	13,729	14,257	12,145
Adjusted-R^2	0.422	0.426	0.417	0.424
Prob>chi2	0.002		0.070	

Panel C. Agency problem

	High-governance	Low-governance	High-governance	Low-governance
	Proxy= Analyst		*Proxy= Gindex*	
	(1)	**(2)**	**(3)**	**(4)**
$CEOage_{t-1}$	-0.2166***	-0.2738***	-0.1900***	-0.1773**
	(-3.272)	(-3.020)	(-2.691)	(-2.297)
Constant	-2.4040***	-3.6150***	-3.2225***	-3.5982***
	(-5.941)	(-5.779)	(-6.946)	(-7.114)
$Controls_{t-1}$	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Observations	12,566	13,836	15,379	11,023
Adjusted-R^2	0.418	0.418	0.45	0.383
Prob>chi2	0.548		0.936	

Table 10. Further heterogeneity tests

This table reports the regression results of two additional heterogeneity tests. In Panel A, we divide our sample into SOEs and non-SOEs. In Panel B, we divide our sample based on the sample median of the SA index. The regression specification is the same as those reported in Table 2. The statistical significance of the differences in the estimated coefficients of *CEOage* between two sub-samples is examined using seemingly unrelated tests. The detailed definitions of all variables are in Appendix Table A1. The t-values reported in parentheses are based on robust standard errors. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

	SOEs	**Non-SOEs**	**High-constraints**	**Low-constraints**
	(1)	**(2)**	**(3)**	**(4)**
$CEOage_{t-1}$	-0.2586***	-0.1886***	-0.0797	-0.3493***
	(-2.806)	(-3.099)	(-1.103)	(-4.713)
Constant	-1.0408*	-3.3914***	-4.1122***	-0.5486
	(-1.853)	(-8.434)	(-9.005)	(-0.783)
$Controls_{t-1}$	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	8,745	17,657	13,488	12,914
Adjsuted-R^2	0.388	0.444	0.429	0.423
Prob>chi2	0.651		0.082	